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MISCELLANEOUS OBSERVATIONS

O N

P L A N T I N G, &c.



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A  
PRACTICAL DISCOURSE  
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C H I M N E Y S:

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Illustrated with COPPERPLATES.



MISCELLANEOUS OBSERVATIONS

ON

PLANTING AND TRAINING

TIMBER-TREES;

PARTICULARLY CALCULATED FOR

THE CLIMATE OF SCOTLAND.

In a SERIES of LETTERS.

---

By AGRICOLA.

---

EDINBURGH:

Printed for CHARLES ELLIOT, Edinburgh;  
and THOMAS CADELL, London.

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M, DCC, LXXVII.

Cup. 504. C30.

MISCELLANEOUS OBSERVATIONS

THE RIGHT HONORABLE

OF

THE HOUSE OF COMMONS

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TO  
THE RIGHT HONOURABLE  
L O R D   H A D D O,  
WHOSE FIRST APPEARANCE IN LIFE  
GIVES ROOM TO HOPE  
THAT THE INFLUENCE HE WILL DERIVE FROM  
AN AMPLE FORTUNE  
AND  
ILLUSTRIOUS BIRTH  
WILL BE EXERTED IN PROMOTING THE IMPROVEMENTS  
OF  
HIS NATIVE COUNTRY;  
THE FOLLOWING PAGES  
ARE HUMBL Y INSCRIBED  
BY  
THE AUTHOR.

THE NATIONAL COLLEGE

LETTER FROM THE NATIONAL COLLEGE

TO THE NATIONAL COLLEGE

THE NATIONAL COLLEGE

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## A D V E R T I S E M E N T.

*The following LETTERS were first published in the Edinburgh Weekly Amusement, and have been reprinted by themselves, at the Request of several Persons eminently distinguished for their Knowledge and Public Spirit.*

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MISCELLANEOUS OBSERVATIONS  
ON  
P L A N T I N G.

---

LETTER FIRST.

*General Observations on the great Profit that  
may be made by judicious Plantations of  
Timber Trees.*

S I R,

Feb. 28. 1771.

**W**HILE the great men, who surround the throne of our most gracious Sovereign, are wrangling about places and pensions, and trying who can prevail in the contest for riches

A

and

and honours ; while *Junius* is studying how he can best annoy the men in power, and *North* is putting on his armour for defence ; while *Cambden* is turning over the musty records of antiquity, for precedents of law to confound his antagonist, and *Mansfield* is preparing himself to meet this doughty champion ; while *Chatham* is publishing his oracular speeches, to convince the world that he alone is able to penetrate the designs, and frustrate the attempts of all our enemies ; while *Rockingham* calls forth his myrmidons, and *Burke* and *Barre* sound the dread alarm of war, of bloodshed, and of total desolation ; let us, who live at a distance from these tumultuous scenes, look up with indifference on all these several contests, little solicitous about the success of either party, being convinced that disputes of this sort must ever be the necessary attendant, and perhaps the surest guard of public liberty ; and, while we laugh at the specious prettexts which they employ

employ to impose upon each other, let us, without peevishness, allow them to enjoy, as well as they can, their short-lived glory, and plume themselves upon their fancied superiority, while we, with diligence and assiduity, endeavour, each of us, faithfully to perform that task which Providence has allotted us, and, in our more humble sphere, contribute what is in our power for the public good, by encouraging every useful art, and carrying on, with a cheerful alacrity, every improvement that can benefit the nation, while, at the same time, it promotes the happiness of individuals. It is with a view to turn the attention of my countrymen to an object of much consequence to many individuals among us, as well as of the most general utility to this antient kingdom, that I give you the trouble of this letter.

The scarcity of wood is a general complaint throughout all Britain, especially in Scotland; which is the more to be regret-



ted, as there are so many extensive tracts of land in almost every corner of it, entirely proper for raising wood, which are at present of almost no value at all,—the produce being next to nothing. I would therefore strongly recommend this subject to the attention of the proprietors of such land, and beg of them seriously to examine of what importance it might be to themselves and their heirs, if a small part of these barren wastes was covered with trees; and I am satisfied, that a very little reflection will soon convince them of the great utility of it.—That any one who turns his attention this way, may not be imposed upon by false reasoning, I would likewise recommend to him to take the opinion of any of his neighbours, who, in the younger part of his life, may have made any considerable plantation of trees;—or let him go to any thriving wood, and carry with him a man who is a judge of the value of the trees which are in it, and compute what  
may



may be the value of the wood on one acre, and I shall not be afraid that he will draw an unfavourable conclusion; although I am sensible, that nineteen plantations out of twenty, which have been made in this country, have been executed with so little judgment, that the proprietor does not draw near the one half of what he might have done by a more judicious proceeding; as I shall probably have occasion to show hereafter.

I believe many persons are prevented from planting trees, by thinking that such a great length of time must elapse before they can reap any profit or advantage from them. And indeed trees, like children, advance so gradually in their growth, that we do not perceive their encrease by looking at themselves, unless we compare them with some fixed standard,—which we more seldom apply in the one case than the other. It would, however, be very easy for me to produce, from accurate calculations,

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culations, the clearest proof, that these advance so fast, as that few men, except when on the very verge of old age, have not a reasonable prospect of reaping considerable advantage from their plantations in their own life-time; but, as I would always wish rather to refer to experience than reasoning, I shall here omit these calculations, and only beg of the reader to open his eyes, and be attentive, and he cannot fail of meeting with abundant proof of this. If he is acquainted with East Lothian, I would bid him observe the wood of *Tinningham*, from which the Earl of Haddington at present draws such a considerable revenue, and be informed that this wood was planted by the late Countess-dowager of Haddington, after she was become a widow, and well stricken in years; yet, notwithstanding this unfavourable circumstance, she had the pleasure, several years before her death, to see this wood, planted at such an advanced period of her life, abundantly repay

repay to her son all the expence and care she had been at; and used to boast, with a very allowable species of vanity, that this field, which had come into her possession a barren waste, had, by her management, become one of the most valuable that belonged to the family of Haddington.

Many other instances of the same kind might easily be produced, to show the speedy, though imperceptible advance, that trees make in growth: but, to render this still more plain and obvious to the senses, I shall here present the reader with a table, showing the real encrease of twelve trees in sixteen years, as they were actually measured by Mr Robert Marsham, and recorded in the Philosophical Transactions, vol. LI. I must, however, observe, that I have taken only the two first columns from the Table he published, having altered the others where I found them defective. For, as he has supposed, that all the trees were of an equal height, and made  
his

## 8      O B S E R V A T I O N S

his calculations accordingly, it is obvious they must be erroneous ; for every one knows that a tree, till it arrives at a very considerable size, continues to advance in height as well as in girt ; so that, to make an exact measurement of its contents, it is necessary to attend to both these particulars. To do this in the most accurate manner I could, I have

|                                         | Girt.<br>Feet. | Height.<br>Feet. |
|-----------------------------------------|----------------|------------------|
| assumed as <i>data</i> , that trees ad- | 1              | 10               |
| vance in height in the same             | 2              | 15               |
| proportion with respect to their        | 3              | 19               |
| girt, as is expressed in the mar-       | 4              | 23               |
| gin, which the reader may cor-          | 5              | 25½              |
| rect, if he thinks they are erro-       | 6              | 27               |
|                                         | 7              | 28½              |
|                                         | 8              | 29               |
|                                         | 9              | 29½              |
|                                         | 10             | 30               |

neous ; but it will be necessary for him to observe, that, although when trees turn old, they advance but little in height ; yet, as their boughs become large, and afford wood as well as the trunk, these ought to be measured as well as the body of the tree ; so that I imagine that the height which I have assigned to the largest trees,

is



is rather under than above the truth. Having premised this much, I subjoin the Table, with the corrections, as under.

A TABLE, shewing the encrease of twelve Trees in sixteen years, from actual Measurements taken by Robert Marsham, first in April 1743, before they began to grow, and again in Autumn 1758, after that year's growth was complete.

| Different sorts of Trees measured.       | Girt in |      | Height in |      | Solid Con. |      | Incr.            |                  |     |   |     |   |    |   |
|------------------------------------------|---------|------|-----------|------|------------|------|------------------|------------------|-----|---|-----|---|----|---|
|                                          | 1743    | 1758 | 1743      | 1758 | 1743       | 1758 | 16 Y.            |                  |     |   |     |   |    |   |
| I. An Ash planted since the year 1647    | 9       | 10   | 4         | 11   | 1          | 0    | 29 $\frac{3}{4}$ | 30 $\frac{1}{2}$ | 172 | 9 | 230 | 6 | 57 | 7 |
| II. An Oak past thriving, but sound      | 9       | 4    | 4         | 10   | 1          | 0    | 29 $\frac{1}{2}$ | 30               | 149 | 3 | 190 | 3 | 41 | 0 |
| III. An Oak about 80 years old           | 5       | 3    | 3         | 7    | 8          | 3    | 27 $\frac{1}{2}$ | 28 $\frac{3}{4}$ | 67  | 5 | 118 | 0 | 50 | 5 |
| IV. A Scots Fir, sowed in 1698           | 5       | 4    | 6         | 6    | 6          | 0    | 26               | 27 $\frac{1}{2}$ | 46  | 2 | 72  | 9 | 26 | 7 |
| V. An Oak planted about 60 years         | 5       | 11   | 1         | 7    | 2          | 3    | 26 $\frac{3}{4}$ | 28 $\frac{3}{4}$ | 57  | 1 | 91  | 9 | 34 | 8 |
| VI. A Spanish Chestnut near 60 years old | 4       | 4    | 0         | 5    | 6          | 3    | 23 $\frac{1}{2}$ | 26 $\frac{1}{4}$ | 27  | 5 | 51  | 6 | 24 | 1 |
| VII. Another 45 or 46 years old          | 2       | 9    | 6         | 4    | 4          | 4    | 18               | 23 $\frac{1}{2}$ | 8   | 4 | 27  | 5 | 19 | 1 |
| VIII. An Oak planted by myself in 1720   | 2       | 11   | 2         | 5    | 1          | 2    | 18               | 23 $\frac{1}{2}$ | 9   | 5 | 37  | 9 | 28 | 4 |
| IX. A Scots Fir planted in 1634          | 1       | 11   | 6         | 4    | 0          | 0    | 15               | 23               | 3   | 7 | 23  | 0 | 19 | 3 |
| X. A Pinaster planted in 1734 or 35      | 2       | 5    | 1         | 4    | 3          | 1    | 17               | 23 $\frac{1}{2}$ | 6   | 4 | 26  | 5 | 20 | 1 |
| XI. An Oak sowed in 1719                 | 1       | 7    | 0         | 2    | 8          | 2    | 13               | 18               | 2   | 0 | 7   | 9 | 5  | 9 |
| XII. An Oak planted in 1720 or 21        | 2       | 9    | 5         | 4    | 9          | 4    | 18               | 25               | 8   | 7 | 35  | 2 | 26 | 5 |
| Total increase in 16 years               |         |      |           |      |            |      |                  |                  | 353 |   |     |   |    |   |

B

From

From this table it appears, that twelve trees have encreased three hundred and fifty-three cubic feet in sixteen years; which, if sold at one shilling *per* cubic foot, would amount to 17 l. 13 s. sterling. Now, if we should suppose a Scots acre of ground planted with trees thriving at the same rate, at ten feet distance from one another, it would contain 540 trees, and would of consequence yield of encrease 15885 cubic feet in sixteen years; which, if sold at one shilling *per* cubic foot, would amount to something better than 794 l. sterling; which, divided by sixteen, gives 49 l. 10 s. for the annual produce: Or, if the wood were sold at sixpence *per* cubic foot, it would give 24 l. 15 s. *per annum*; or, if at threepence *per* cubic foot, 12 l. 7 l. 6 d.; or at one penny *per* foot, it would yield 4 l. 2 s. 6 d. *per annum*; which is a profit great enough to satisfy the most avaricious. And although we should allow

low it to be highly probable, that the trees which form the subject of this experiment, have been more favourably situated, and perhaps advanced faster than could be expected in a general plantation, we have room to make considerable deductions on that account, without diminishing the profits near so much as most people would be satisfied with; as even one tenth of the smallest of these calculations is more than is generally drawn for good arable land in many parts of this kingdom.

I shall not at present trouble you with many remarks upon this Table, as I shall only observe, that from it we may learn, That although trees encrease faster when young, in proportion to their size, yet large trees do really produce more wood in an equal space of time than small ones. Thus No. I. produces, in sixteen years, 57.7. cubic feet of wood, which is precisely one fourth of its whole bulk; whereas

No. IX. encreases only 19.3. cubic feet, which is three-fourths of the whole bulk nearly. Whether the greater space necessary to be allowed to large trees than young, would be sufficient to counterbalance the greater produce, I cannot exactly say; but I am disposed to imagine it would, as we see that young trees bear to be much closer upon one another than when older; so that probably an acre of young growing wood would produce as much as one of full-grown trees in an equal number of years. But whatever may be the case with regard to large plantations, it is obvious, that such trees as stand single, and are advanced to a considerable size, continue to encrease in quantity very much; so that every one who has such trees ought to preserve them with care, as they are continually gaining more and more, and adding to the stock of the proprietor in a much higher degree than any  
*interest*



*interest* he could get for the money which he would draw from felling them.

It is likewise worth remarking, that, of all the trees mentioned in this Table, none of them (except the large thriving Ash, No. I.) advance so fast as the Oak. I would wish that my countrymen would pay a particular attention to this circumstance; because there seems to be a general prejudice among the people of Scotland against this noble tree, so justly termed the *king of the woods*; it being imagined, from its slow progress at first, and the length of time it continues to thrive, that it makes but very little progress; but this notion is sufficiently refuted by experience, as this Table shows. It is worth observing, that even Mr Marsham himself was deceived by this tree; as he had imagined that No. II. was past thriving, and yet it encreased, in sixteen years, 41 cubic feet; which, at the ordinary felling price of that wood, is worth

worth 4l. sterling and upwards. I shall not now take up more of your time; but may, perhaps, on some future occasion, send you some further remarks upon this subject.

AGRICOLA.

P. S. Since the above was written, I have met with the following facts that strongly confirm the observations contained in the foregoing letter, and therefore deserve the particular attention of the reader.

Mr Arthur Young, in his Eastern tour, takes notice of the improvements of Mr Mellish, in the following terms. " Mr Mellish has, for many years, raised numerous plantations, which are a very great ornament, not to his estate only, but to the whole country. In this noble pursuit, he has gained much experience in planting

ing sandy soils especially, from trying various methods, and different sorts of trees. Some pieces of forest-land he has cleared from the spontaneous rubbish, in the same manner as for corn, and ploughed it once in the common manner, upon which he set the trees. Others he trench-ploughed, and set them; and, upon some other pieces, he did not plough at all, and cleared no more than necessary to make the holes to plant them in. The result of these various trials was indeterminate, each nearly equal; but, if any difference, those planted after clearing and ploughing were the best. The sorts tried were Scots and spruce firs, larch, oak, ash, chesnut, beech, birch, &c. the whole mixed. Scots and spruce firs have grown much faster than any of the rest, and they have all so generally succeeded, that scarcely one in ten thousand have failed. The soil he has chosen is forest-land of 3 s. an acre.

The

## 16 OBSERVATIONS

The number he has generally set on an acre is 5000; the expence of inclosing, raising the trees, and planting, is 3 l. an acre. In five years they require thinning; the value of the wood taken out about pays for the labour\*; the number taken out about 1000.

In five years more they are thinned again, when another thousand trees are taken out, which make very good hedge-wood and hedge-stakes. The value about 5 l. more than what pays the labour.

After these thinnings, 3000 are left, which Mr Mellish has found from experience to be then worth 6 d. each, on an average, as they stand, clear of all expences, if sold. At this time another thousand should be taken out.

Two thousand are therefore left, which, at thirty years growth, will be worth, as

\* Firs should always be cut in the middle of summer, in full turpentine.

they



they stand, 1 s. each; and, at forty years, they will be worth 2 s.

This is the state of the planting-produce on the poor forest-lands: but Mr Mellish has many Scots firs, planted thirty-five years ago on good land, which are now worth 40 s. each, and very many from 25 s. to 35 s.

Upon these *data* we may easily calculate the profit of planting at different periods.

*Account of an acre of Firs at the end of the fifth year.*

|                                                    | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|----------------------------------------------------|-----------|-----------|-----------|
| First inclosing *, raising, planting, fencing, &c. | 3         | 0         | 0         |
| Interest of the above sum for five years           | 0         | 15        | 0         |
| Rent - - - - -                                     | 0         | 15        | 0         |
|                                                    | <hr/>     |           |           |
|                                                    | 4         | 10        | 0         |
|                                                    | <hr/>     |           |           |

*In Five years more.*

|                                         |       |    |   |
|-----------------------------------------|-------|----|---|
| Reparation of the fences - - -          | 0     | 5  | 0 |
| Interest of 4 l. 10 s. for five years - | 1     | 2  | 6 |
| Allow for compound interest - - -       | 0     | 15 | 0 |
| Rent - - - - -                          | 0     | 15 | 0 |
|                                         | <hr/> |    |   |
|                                         | 2     | 17 | 6 |
| First five - - - - -                    | 4     | 10 | 0 |
|                                         | <hr/> |    |   |

\* This price is for a large field of 10, 15, or 20 acres, and not a single acre. It is the proportion of the whole.

# 18 OBSERVATIONS

|                                 | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|---------------------------------|-----------|-----------|-----------|
| Expence at the end of ten years | -         | 7         | 7 6       |
| Received for thinnings          | -         | 5         | 0 0       |
| Excess                          | -         | 2         | 7 6       |

*At the end of Twenty years.*

|                      |   |   |      |
|----------------------|---|---|------|
| Rent                 | - | 1 | 10 0 |
| Reparation of fences | - | 0 | 10 0 |
| Interest             | - | 1 | 0 0  |
|                      |   | 3 | 0 0  |

|                                       |   |    |     |
|---------------------------------------|---|----|-----|
| Received for 1000, at 6d.             | - | 25 | 0 0 |
| Value of 2000 remaining, at same rate | - | 50 | 0 0 |
|                                       |   | 75 | 0 0 |

|                                 |   |   |     |
|---------------------------------|---|---|-----|
| Deduct, as above                | - | 3 | 0 0 |
| Excess at the end of five years | - | 2 | 7 6 |
|                                 |   | 5 | 7 6 |

|                              |   |    |      |
|------------------------------|---|----|------|
| Clear profit in twenty years | - | 69 | 12 6 |
|------------------------------|---|----|------|

|                                    |   |   |     |
|------------------------------------|---|---|-----|
| Which is <i>per acre per annum</i> | - | 3 | 9 1 |
|------------------------------------|---|---|-----|

But, supposing the 2000 trees left ten years longer, the account will stand as under.

|                           |   |    |     |
|---------------------------|---|----|-----|
| Received for 1000, at 6d. | - | 25 | 0 0 |
| Deduct, as above          | - | 5  | 7 6 |

|                                                      |   |    |      |
|------------------------------------------------------|---|----|------|
| Profit in twenty years, exclusive of trees remaining | - | 19 | 12 6 |
|------------------------------------------------------|---|----|------|

|                                                  |   |   |     |
|--------------------------------------------------|---|---|-----|
| Which, <i>per acre per annum</i> , may be called | - | 1 | 0 0 |
|--------------------------------------------------|---|---|-----|

*At the end of Thirty years.*

|          |   |   |      |
|----------|---|---|------|
| Rent     | - | 1 | 10 0 |
| Fences   | - | 0 | 10 0 |
| Interest | - | 1 | 0 0  |
|          |   | 3 | 0 0  |

Supposing

# ON PLANTING. 19

|                                                                         | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|-------------------------------------------------------------------------|-----------|-----------|-----------|
| Supposing the plantation then cut down,<br>the 2000 trees, at 1s. bring | -         | 100       | 0 0       |
| Deduct, as above                                                        | -         | 3         | 0 0       |
| Profit                                                                  | -         | 97        | 0 0       |
| First ten years expence                                                 | -         | 7         | 7 6       |
| Second ten ditto                                                        | -         | 3         | 0 0       |
| Third ditto                                                             | -         | 3         | 0 0       |
| Total expence                                                           | -         | 13        | 7 6       |
| Received second thinning                                                | -         | 5         | 0 0       |
| Third ditto                                                             | -         | 25        | 0 0       |
| The 2000 remaining                                                      | -         | 100       | 0 0       |
| Total                                                                   | -         | 130       | 0 0       |
| Expences                                                                | -         | 13        | 7 6       |
| Clear profit in thirty years                                            | -         | 116       | 12 0      |
| Or <i>per acre per annum</i>                                            | -         | 3         | 17 1      |

## *At the end of Forty years.*

|                                   |        |     |      |
|-----------------------------------|--------|-----|------|
| Expences as before                | -      | 3   | 0 0  |
| Received for 2000 trees, at 2 s.  | -      | 200 | 0 0  |
| Ditto, first and second thinnings | -      | 30  | 0 0  |
| Total                             | -      | 230 | 0 0  |
| Deduct expences, as before        | 13 7 6 |     |      |
| Ditto                             | 3 0 0  |     |      |
|                                   |        | 16  | 7 6  |
| Clear profit in forty years       | -      | 213 | 12 6 |
| Or <i>per acre per annum</i>      | -      | 5   | 6 1  |

This account of the expences, produce, and profit, of planting forest-land, at 3 s. an acre, shews the amazing profit of such undertakings. Plantations have, in general, been raised with a view merely to beauty, or else through a very noble patriotic motive of being serviceable to the country; but it is evident that they may be undertaken with very different views: with those of profit. So that a man may cut down the trees he planted himself, and expect to reap, in so doing, very considerable profit.

If he cuts all down at the end of twenty years, and leaves not a single tree, he gains a profit clear of near 70 l. an acre, which is 3 l. 9 s. *per acre per annum* from the first planting. Let me ask the most skilful farmers of this country, how they will exceed such a profit, by any system of common husbandry, on such poor land? It before appeared, that common good husbandry,



bandry, after some improvements, would yield but 1 l. 1 s. 11 d. *per* acre profit; so that the planting, to cut in twenty years, is more than thrice as beneficial, and certainly much less exposed to accidental losses.

But supposing the trees left thirty years, in that case the thinnings pay, for the first twenty years, 1 l. *per* acre *per annum*; and, at the end of the thirtieth, the account from the first planting is 3 l. 17 s. 1 d. *per* acre; and, in forty years, 5 l. 6 s. 1 d. After which time they may be supposed to decline in quickness of growth, and consequently had better be cut down in point of profit.

If beauty of situation is not, in some respects, commanded, we seldom see plantations of quick-growing trees; but it is evident that poor soils should be planted upon the mere view of profit: a crop of firs, instead of a crop of wheat, barley, or  
oats,

oats, at twenty years growth, which so many men may expect to see out in perfection, will turn out far superior. One of the most profitable farms would be a thirty years lease of such land, with liberty to plant and cut down. One of twenty years, which is a shorter period than the generality of long leases, would, thus applied, exceed common husbandry on such soils."

These are not the only successful experiments on planting recorded by that rural traveller. In recording the experiments of Sir John Turner (of Warnford in Norfolk), he takes notice,

*Experiment, No. 7.*

That " Sir John Turner has not only planted many acres as an addition to the beauty of his situation, but has also attended to the growth of the trees, for discovering  
covering

covering the profit of planting on his soils. In one plantation, Scots firs, at 12 years growth, are worth 1 s. each.

*Experiment, No. 8.*

In a plantation of 50 years growth, the land 8 s. an acre, the trees are various, and the value as follows:

Oak, worth 10 s. each.

Ash, 12 s. 6 d. ditto.

Elm, 10 s. ditto.

Scots fir, 7 s. 6 d. ditto.

Lime, 5 s. ditto.

Suppose the number of each equal, the average value is 9 s. The number about 500 on an acre.

Five hundred trees, at 9 s. are 225 l. or 4 l. 10 s. *per acre per annum*, from the first planting; but the thinnings have produced very considerable sums: and the grass under the trees would now let at 5 s. an acre.

*Experiment,*

*Experiment, No. 9.*

In another plantation of 50 years growth, on land of 8 s. an acre, the trees, 250 *per* acre, are worth—

The oak, 16 s. each.

Ash, 10 s. ditto.

Lime, 9 s. ditto.

Scots fir, 16 s. ditto.

Average, 12 s. 9 d.

Two hundred and fifty at that price come to 154 l. 7 s. 6 d. *per* acre, besides the thinnings: this is above 3 l. *per* acre *per annum* from the first planting.

Had all been oak or fir, the total would have been 200 l. *per* acre, or 4 l. *per* acre *per annum* from the first planting.

*Experiment, No. 10.*

In another plantation, elms of 40 years growth (300 on an acre), are worth 22 s. each; this is 330 l. *per* acre, or more than 8 l. *per* acre *per annum*; and the land  
now



now would let as well as before the planting.

*Experiment, No. 11.*

A plantation of Scots firs, of 15 years growth, 300 on an acre, are worth 1s. 6d. each. This is 22l. 10s. an acre, or 1l. 10s. *per acre per annum*, besides thinnings.

The great profit of planting is obvious from these trials; but the whole state of the case by no means appears here; for the product of the thinnings is considerable. Sir John calculates, that he never receives less than a guinea an acre in thinnings throughout his plantations; which is easily to be conceived, as they are at first planted only four feet asunder.—The lowest profit here mentioned is 1l. 10s. an acre; add 1l. 1s. for thinnings, it is 2l. 11s. *per acre*; deduct 11s. rent and expences, there remains 40s. an acre clear profit; which is more than the farmers

D

make

## 26 OBSERVATIONS

make by all their trouble, industry, and hazard."

And again, in recording the experiments of William Fellowes, Esq; of Shottesham, he gives the following account of his plantations.

" Mr Fellowes has given yet greater attention to planting than to husbandry, and has tried various trees some years ago; so that he is now able clearly to judge which is the most profitable.

### *Experiment, No. 9.*

A plantation of Scots firs, of 45 years growth, 20 feet square, on land of 15s. an acre, are now worth 20s. each on an average. At that distance there are 108 trees on an acre, or 108l.; which is 2l. 9s. *per acre per annum* from the first planting, exclusive of thinnings, which would more than double it. But the grass under  
der

der the trees would have let, for many years past, at 7s. an acre.

*Experiment, No. 10.*

Another plantation of Scots firs, 38 years growth, standing in rows 14 feet wide, and 10 in the row, are now worth 10s. on an average. This distance gives 300 on an acre; and, at 12s. come to 180l. or 4l. 14s. *per acre per annum*, besides thinnings. The rent of the land 15s.; poor-rates, 1s. 3d. in the pound; and tythe, till 20 years old, 5s. an acre; the grass under them now 5s. an acre. It is sufficiently evident that no husbandry can equal this.

*Experiment, No. 11.*

Chestnuts, in 38 years, on the same land, standing 14 feet by 10, are worth 15s. each. This is 225l. *per acre*, or 5l. 16s. *per acre per annum*, besides thinnings.

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### *Experiment, No. 12.*

Scots firs, in 38 years, on the same land, measure 17 feet of timber on an average, for which Mr Fellowes has been offered 11 d. a-foot; that is, 15 s. 7 d. a tree. They stand 14 feet by 10. An acre would therefore be 233 l. 15 s. or 6 l. 3 s. *per acre per annum*, besides thinnings. These trees are 60 feet high.

### *Experiment, No. 13.*

On the same land larch-trees, of only 31 years growth, are as large as the firs of experiment, No. 12. which shews that the larch is a much quicker grower. Spruce by them, not so large as either. The pinafter of 38 years, larger than the Scots: the cedar of Lebanon, of the same age, would now cut into planks 12 inches wide.

### *Experiment, No. 14.*

A very striking comparison between the  
larch



larch and the spruce-fir was tried by planting an old gravel-pit levelled, surrounded by a plantation of Scots firs, with those two sorts in alternate rows: The larch is from 6 to 12 feet high; whereas the spruce is but 2 feet on an average.

*Experiment, No. 15.*

A large plantation of many acres of a poor gravelly land, at 8s. an acre, containing Scots and spruce-firs and larches, is now 16 years old; they are in squares of 10 feet, and are worth—

The Scots, 2s. 6d. each.

The spruce, 3s. 6d. each.

The larches, 4s. 6d.

At ten feet, there are 435 trees on an acre.

The Scots, at 2s. 6d. come to 54l. 7s. 6d.; or *per acre per annum*, 3l. 7s.

The spruce, at 3s. 6d. to 76l. 2s. 6d. or *per acre per annum*, to 4l. 15s.

The

The larch, at 4s. 6d. to 97l. 17s. 6d.;  
or *per annum*, 6l. 2s.

All these exclusive of thinnings.

Suppose we calculate these at no more than paying the rent, tythe, and town-charges, and that the larch, in 20 years, come only to 100l. which is, however, under the truth; let any one calculate the profit of hiring land on a twenty-one (or more) years lease, and immediately planting. In what other application of the land can such great profit be made, as gaining 6l. an acre without any risk, and almost without any expence? It is true, such a conduct cannot, like the culture of corn and grass, be general, for reasons obvious to every one; but, as far as the whole demand of any neighbourhood extends, it is profitable to execute it. Such a demand is every-where very great, for the use of rails, spars, beams, board, planks, &c. &c. according to the age of  
the

the trees; and great quantities of these are perpetually importing from the Baltic. So far, therefore, as the demand extends, it is highly adviseable to plant these trees.

Suppose five acres of larch planted every year; at the end of 16 or 17 years, five acres will every year be cut down, of the value of 500 l.; from that day a regular product of 500 l. a-year is gained from the application of 100 acres of land. Let to a tenant, these 100 acres produce 40 l. a-year; but planted, they produce 580 l. a-year. What an amazing difference!

Suppose a single acre planted every year, after the expiration of 18 or 20, to cut annually 100 l. a-year from only 20 acres, which let, would yield but 8 l. a-year. How beneficial a conduct!

It should here be observed, that the larch is valued the same as the Scots fir; but the best authorities tell us, the timber  
is

is one of the most useful yet known ; probably, therefore, the value of it would turn out greater than the supposition in these experiments.

*Experiment, No. 16.*

Sixteen Scots firs and two pinasters raised from seed, sown between Michaelmas 1732 and Lady-day 1733, were measured June 7. 1768. The measure is exclusive of the bark, for which 6 feet *per* load was allowed ; the bark being very thick, they were valued at 9 d. a-foot, they being full of sap. The 306 feet come to 11 l. 9 s. 6 d. The trees stand in a row at unequal distances ; but are on an average at 15 feet.

No. 1.



No. 1. Scots fir—22 feet.

2. Ditto—13

3. Ditto—21

4. Ditto—26

5. Ditto—9

6. Ditto—22

7. Ditto—16

8. Ditto—10

9. Ditto—22

10. Ditto—18

11. Ditto—15

12. Ditto—22

13. Ditto—22

14. Ditto—8

15. Ditto—18

16. Ditto—16

17. Pinaster—11

18. Ditto—15

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306

A beech sown at the same time, measured, on January 21. 1769, 19 feet 7 inches.

Mr Fellowes has had both the boughs and seed of the red deal from Norway, and he finds that it is the Scots fir.

In a regular planting and cutting down a given quantity of land, it would be adviseable, I should apprehend, to plant the old land again, which would save grubbing

E

up

up the stumps and roots, which, in rotting, would turn to a rich manure for the new trees.

Plane-trees Mr Fellowes has planted; and he finds them to thrive amazingly in low moist situations. It will in such grow much faster than the poplar. One he has of 30 years growth, that will cut into planks 20 inches broad; but so vast a size he attributes, in some measure, to its standing on the edge of a ditch through which the drainings of a farmer's pig-sties run. Poplars, in some parts of the kingdom, are planted in low situations, to the exclusion of every thing else: it is of consequence, therefore, to know that the plane will do better; and in beauty it infinitely exceeds that ragged, crooked, unsightly tree, the poplar.

Mr Fellowes in general recommends the larch as preferable to every other tree that he has tried; and which will pay a planter  
much

much greater profit than any of the rest. As to the method of cultivating them, or any firs, he is of opinion that the land should be cropped with turnips, and the trees set about the 10th of April following; but, if that season is omitted, late in August will do. They should be 2 years old, and set at 4 feet square. For four years it will be adviseable to hand-hoe the land about them twice a-year, which will cost 3 s. each hoeing; after that there will be no further expence."

To these may be added the experiments of Mr Arbuthnot on planting the black poplar and willow.

" Nine years ago (says Mr Arbuthnot) I planted some black poplars, eight feet asunder; the size about  $1\frac{1}{2}$  inch diameter: measured two of them. No. 1. the best, contains 13 feet of timber, which would

# 36 OBSERVATIONS

fell at 10 d. a-foot, and the forks in the top would give three rails, worth, with the faggots, 2 s. In all 12 s. 10 d.

No. 2. the worst, 12½ feet of timber, and the top worth 1 s. In all 10 s. 5 d.

Average, 11 s. 7 d.

An acre, planted in squares of 8 feet, would contain 680 trees, which, at 11 s. amount to

£. 393 0 0

## Expences.

Suppose the trees bought or raised at 3 d.

|                                        |   |   |   |    |    |   |
|----------------------------------------|---|---|---|----|----|---|
| each                                   | - | - | - | 8  | 10 | 0 |
| Planting                               | - | - | - | 0  | 5  | 0 |
| Filling vacancies by death; suppose 50 | - | - | - | 0  | 12 | 6 |
| Fencing repairs                        | - | - | - | 0  | 10 | 0 |
| Nine years rent, suppose at 30 s.      | - | - | - | 13 | 10 | 0 |

Total 23 7 6

|          |   |   |   |     |   |   |
|----------|---|---|---|-----|---|---|
| Product  | - | - | - | 393 | 0 | 0 |
| Expences | - | - | - | 23  | 7 | 6 |

|                             |   |   |   |     |    |   |
|-----------------------------|---|---|---|-----|----|---|
| Profit                      | - | - | - | 369 | 12 | 6 |
| Which is per acre per annum | - | - | - | 41  | 1  | 4 |

No husbandry or gardening in the world will equal this vast profit. It is astonishing that more plantations of such quick-growing trees are not made. This soil is black, rich, low ground, near water.

*Experiment,*



*Experiment, No. 3.*

Some willows, planted at the same time and distance, measured, on an average, 18 feet of timber, worth 6 d. a-foot, and the tops 1 s. 6 d.

|                              |        |     |      |
|------------------------------|--------|-----|------|
| 680, at 10 s. 6 d.           | £. 357 | 0   | 0    |
| Expences as before           | -      | 23  | 7 6  |
| Profit                       | -      | 333 | 12 6 |
| Or <i>per acre per annum</i> |        | 37  | 1 4  |

From which most considerable return, there is no slight reason to suppose the common idea, that this tree should, for profit, have the head cut off, is an error; for it is a question whether the product by faggots would equal half this; but, in situations where poles sell well, Mr Arbuthnot observes, that you may cut them every six years, and sell at an amazing price, but not for faggots. He likewise remarks, that the body of the willow-tree rives into  
pales,

## 38 OBSERVATIONS

pales, which are admirable for fences, hardening in the air, and are nearly as durable as oak."

To these I shall only subjoin the following experiment on the culture of ash-trees by the ingenious Mr Boutcher of Comely-gardens.

" I shall (says he) dismiss this useful, though not ornamental tree (the ash), in mentioning an experiment I made very early in life of its value, by planting a specimen of them in copse, intended principally to supply myself with poles for espalier hedges, and stakes for dead fences; for which purposes no wood is more proper or lasting.

For these ends, in very obstinate heavy meadow-ground, composed chiefly of sterile red clay and moss, I planted a rood, or the eighth part of an acre, with ash-trees  
fix

fix years old, and about eight feet high. I placed them in rows, four feet afunder, and two feet distance in the row, where I let them remain untouched, only digging the ground about them every autumn, for four years, when I cut them over five or six inches above ground for the purpose meant, which they then fully answered; reserving twenty of the fairest plants, at proper distances, for trees.

I continued to dig the ground two years longer, and then left them to nature for five years more, that is, seven from their being cut down. Having more of them than answered my own purposes, or indeed than I could have imagined so small a spot of ground would produce, I thought of making the most of what I had to spare, and accordingly measured off exactly one half of them, which I sold for pollards and hoops, at 40s.

I cut them again in six years more,  
which,

## 40 OBSERVATIONS

which, being stronger than the former, I fold for 50 s.

In six years after this, I again cut them over, and though these were much the largest shoots, I fold them at the same price as the last.

There remained now twenty trees in the whole ground, intended to stand for timber, ten of which grew amongst the copse I had fold. My meaning was, not to touch these till the decline of my life, that I might leave to posterity what observations I was able to make, of the profit a man who begins to plant when young, may reap from it in his own time. But the cross events of life disappointed me; for becoming security in considerable sums for others, who failed in their affairs, I was obliged, by rigid creditors, to sell my land, at which time my necessities also constrained me to sell my trees of all kinds. I hope the reader will excuse this digression,



sion, which I believed necessary, to remove the just reflection every judicious planter would make against me, for cutting down hopeful trees at so early and unprofitable a period, if I could have avoided it. Those trees I sold, of twenty-three years growth, at 7s. a tree to a cartwright, which was 3l. 10s. for the ten trees on the copse-ground I had cut and sold three times before.

Thus it appears, that an acre of indifferent ground, (for mine was very bad), planted with ash-trees in the manner described, near, or easily carried to any populous town, will yield in twenty-three years time 168l. \*, without any other expence

\* In the text Mr Boutcher has here only 115l. 10s.; which must be evidently a mistake: for from the foregoing data it appears, that one sixteenth of an acre yielded,

At the first cutting, four years after planting,

nothing charged - £. 0 0 0

At the second cutting, in seven years more 2 0 0

F Carried over £. 2 0 0

expence than digging the ground for the first five or six years, and cutting over the copse, which is very trifling; and which the owner ought, in all events, to do himself carefully, for his own sake: Let them be cut, slanting, with sharp instruments, leaving all the wounds smooth and clean, to prevent the wet from lodging in the stocks, from whence it might communicate to the roots, and contaminate the whole plant, and which a common purchaser of the copse would probably pay little attention to. The best season for this work is the month of Febru-

|                                                                                                                                        |   |            |
|----------------------------------------------------------------------------------------------------------------------------------------|---|------------|
| Brought forward                                                                                                                        | - | £. 2 0 0   |
| At the third cutting, in six years more                                                                                                |   | 2 10 0     |
| At the fourth cutting, in six years more                                                                                               |   | 2 10 0     |
| For the ten trees at this last period                                                                                                  |   | 3 10 0     |
|                                                                                                                                        |   | <hr/>      |
| Total in twenty-three years                                                                                                            |   | £. 10 10 0 |
| Which, multiplied by 16, is                                                                                                            |   | 168 0 0    |
| or 7l. 6s. 3d. <i>per annum</i> , without reckoning any thing for the first cutting, or for the grass on the field for the whole time. |   |            |

ary,

ary, before the sap begin to rise. I have not mentioned any price for the first cutting, having used them myself. These were planted at eight feet high, and had stood for four years from planting; so that, from the lowest calculation, they must have been worth more than pay the whole expence of labour: To which I must add, that, after selling the last cutting of my copse, I was informed by an honest man, a good judge of the value of that commodity, that I had been grossly deceived by the purchaser, and that I should have received one third part at least more money than I did.

It is necessary to observe, for the benefit of such as may incline to follow this practice, which is surely worth attending to, as it might soon become a very profitable improvement, that, after the second cutting, I found I had planted my copse too thick, and that, had they been at greater

F 2

distances,

## 44 OBSERVATIONS

distances, I should have reaped considerably more advantage from them: I therefore now, from experience, advise them to be planted in rows, six feet asunder, and three feet in the row."

From these successful experiments it will appear evident, that greater profit may accrue to the man who plants trees in a favourable situation, even in his own lifetime, than from almost any other crop whatever: and if we consider that these will often thrive best on such soils, and in such situations as do not admit of culture, these profits will appear still more considerable.

I would be far, however, from insinuating that profits equal to what is recorded in these experiments, may be reasonably expected by those in general who are possessed of barren and unprofitable soils. In an open country, and exposed situation,  
whatever



whatever be the nature of the soil, trees advance much more slowly than in a place that is well sheltered; and it is probable that every one of the places where these experiments were made, enjoyed this advantage in an eminent degree, when compared with those bleak situations in many parts of Scotland, where no bush or tree is to be found to give the smallest interruption to the current of the air, which, in these situations, sweeps along the surface of the earth with almost irresistible fury, and does not permit a tree to live at all, unless protected with the greatest care. Let not those whose situation in any measure resembles this, hope to have any success in rearing trees in the manner mentioned in any of these experiments, for they would certainly be disappointed.

Nor will the profit in many places be nearly equal to what is recorded in these experiments, even if the trees should thrive  
equally

equally well as these did. For the value of wood varies so much by the demand that is for it on the spot, that in most situations the same quantity of timber would not be a fourth part of what it is valued at above; and in some places it could hardly be, *as wood*, valued at any thing at all. Let the sanguine improver attend to this circumstance.

But while I would thus caution the young and inexperienced from *rashly* engaging in extensive improvements of this sort, from the hopes of realising those golden dreams that may be suggested by the foregoing experiments, I would wish to recommend, in the strongest manner I can, to every land-owner to bestow a proper attention on this subject; as I know of no species of improvement that will with so much certainty repay his expence and care, as this will do, when his plantations are made with judgment and discretion. It is

is with a view to assist him in this study that the following letters were written; and it is hoped, that, by a due attention to what is contained in them, many of those errors may be avoided, which have made numerous plantations of trees miscarry in different parts of the country, and such circumstances be pointed out as may render a large plantation of great value to the owner, even in situations where the wood itself can be accounted as nothing.

## LETTER

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L E T T E R   S E C O N D.

*Of the Necessity of Shelter for Trees ;—proper  
Method of planting in an exposed Situation.*

S I R,

May 2. 1771.

**A**CCORDING to my promise, I now send you some further observations on planting and the growth of trees, chiefly collected from my own experience and attentive observation, wishing they may prove of as much general utility as the importance of the subject deserves.

Nothing is in general so prejudicial to trees as wind, which, by loosening the roots and bending the tender branches, stints them in their growth,—keeps them low and stubby, and sometimes even kills them altogether. For this reason we find, that no situation is in general so favourable for the growth of trees in the country,



try, as the banks of rivers and hollow *dells* between mountains, where, by the form of the ground, they are effectually secured from every storm, and sheltered from every tempestuous blast; but in more exposed situations, we are under the necessity of effecting by art what nature has denied; and, if we would wish our trees to thrive, must fall upon some method of protecting them, when young and tender, from the fury of tempestuous winds, otherwise they must inevitably languish, if not perish entirely.

The best method which we have as yet discovered for effecting this purpose, is to make our plantations of considerable extent, where the exposure is bleak, and to plant the trees at first extremely close together, that so they may mutually shelter one another from the violence of the wind; and as the trees advance so as to require a greater space, let the weakest

G

trees

trees be gradually cut down, to leave room for those which are in a more thriving condition; by which means they will be made to advance almost as quickly as those which are planted in a more favourable situation. But nothing can be more absurd than to make a plantation of trees, in an open exposed situation, at the same distance from one another as the trees would require when they should have attained their full size;—or to plant a few straggling trees at a distance from one another, and unprotected by any neighbouring object; as the wind will there have such an impression upon each, at all times, and from whatever quarter it blows, that they will never be able to make any considerable progress. We might almost as soon expect to see a tree advance with vigour in the midst of a bog or a salt-water lake, as to see one which is planted alone in a very exposed situation,

continue

continue in health and vigour. Let not any one, therefore, who may chance to live in a corner of the country where wood is very scarce, and where the few straggling trees that may be in it are poor and stunted, too suddenly despair,—or hastily conclude, that heaven has denied him the power of enjoying this comfortable blessing, till he has thoroughly examined this circumstance; and if he will take the trouble to examine, with his own eyes, other places situated like his own, and trust to the evidence which this will produce, he will soon discover, that the reasons which influence the *great* and the *little* vulgar are fallacious, and are contradicted by such numberless examples, that they can only be considered as ill-grounded prejudices, which he, by a careful attention, may be soon able to destroy. This I speak with the greater confidence, as it is the result of my own

experience: for I myself was exactly in the situation here described, and have now the pleasure of seeing around me as healthy trees as any one could possibly desire; and perhaps the reader will be convinced of this, when I assure him, that I have measured one year's growth of an oak upwards of five feet in length, which grew in a country where, twenty years ago, they would have believed, almost as easily, that you might have reared *pine-apples* in the open air, as to have made that tree advance *one* foot in a season.

But although all trees require to be sheltered from the most impetuous blasts, before they can be reared in the utmost perfection, yet they differ very much from one another in the degree of shelter that they require; some being able to thrive in a situation where others would totally perish. Of all the trees that I am well acquainted with, the *ash*, the *elm* and the

*rawn*



*redwn tree* (the *mountain ash*) are least hurt by open exposure, and therefore thrive best when planted alone or in single rows; and few of our hardy *deciduous* trees are less able to endure an exposed situation than the *oak* when young; which is probably one reason why this last is in so little estimation in this country, and the others so generally cultivated; although it must likewise be acknowledged, that the two first are deservedly much esteemed, not only because they can be reared in almost any situation, but also on account of the valuable qualities of their wood, which is perhaps better adapted to the various purposes of the husbandman than even the sturdy oak itself. All the *coniferous* trees are absolutely incapable of *living* in an unsheltered situation; especially the common *pine*, called *Scots fir*, which can hardly *live*, far less *thrive*, when planted either in single rows, or thinly scattered, unless  
in

in a very sheltered situation ; which is the reason why we so frequently meet with a few stunted trees of this kind in different parts of the country, and is likewise the cause of these trees so quickly falling to decay, after they begin to be thinned in large plantations; no wood whatever receiving so little benefit from the admission of fresh air as this does. But as few trees advance faster when young, in large plantations, and as none afford a better shelter by their numerous branches continually covered with leaves, they are extremely proper for performing the part of nurses to other more valuable trees, when we want to rear them in a situation which is very much exposed; for under the shelter of these, almost any other tree may be reared to perfection. But, for the reasons already given, as well as the small value of the wood, they ought seldom to be planted as a principal crop; especially as they have this further

ther inconvenience attending them, that when they are once cut down they never spring up anew; so that the place where these have been, is in a short time left as bare as it was at first, unless a new plantation is made, which is always troublesome and expensive. This inconvenience ought, therefore, to be guarded against with care; which may best be done by planting other trees along with these *firs* or *pinés*; for as almost all other kinds of trees send up vigorous shoots from the stumps as soon as the old trees are cut over; if they are once established, they may be continued for ever; the plantation being renewed every time that the trees are cut down.

For these reasons, in general, the best method of making a large plantation of trees, is first to fill the whole field very thick with *firs* or other *coniferous* trees, and among these plant other more valuable

able kinds of wood; the proprietor being directed in the choice of the kinds by the nature of the soil,—his own taste, and the particular circumstances of his situation. But it ought to be a general rule to plant many different sorts of trees, that thus there may be a probability of not missing that particular kind which is best adapted to the nature of the soil: For as trees draw their nourishment from a great depth, their growth is much influenced by the nature of the under strata, which we have no means of observing with accuracy;—nor are we as yet sufficiently acquainted with the nature and œconomy of the different sorts of trees to be able to say with precision which kind would thrive best on any given soil, even if the several strata contained in it were clearly seen: on these accounts we have no such certain method as this is of discovering which kind of trees will thrive best upon any particular spot,



spot, as in these circumstances they will soon discover themselves by their superior vigour and healthiness. And although it is allowable for every one to make choice of that kind of tree which suits his own fancy best, if all other circumstances are equal, yet no one ought to be so much attached to his own opinion in this respect, as to reject others where nature has refused to gratify his desire; for it ought ever to be remembered, that a healthy and vigorous tree, even of an inferior kind of wood, is not only more beautiful, but also more valuable, than the very best kind of wood when in a languishing condition.

If a plantation is made in this manner, the *firs* will rush up with vigour, and effectually screen the other trees from every blast; but in a few years it will be necessary to thin these a little, to make room for the other trees as they advance; and as the young trees which are cut out may

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in

in most places be sold to very good account, the proprietor will from this period begin to draw a constant annual profit from his wood, which will continue to encrease every year as the wood encreases, till the whole of the *firs* are cut down; and if the plantation is then divided into a certain number of lots, (more or less numerous, according to the demand that the owner finds for old or young wood), one of which may be felled each year, which being preserved from cattle, will quickly spring up again, so that by the time he comes back to the lot he began with, it will be ready to be cut again; and in this manner he may continue to go over it again and again for ever, as is practised in the wood of Sonien, near the city of Brussels in the Netherlands, which yields an annual revenue of more than 6,500 l. sterling \*, and has done so without interruption.

\* I wrote this upon the authority of *Guicciardin*, in his description

tion for many hundreds of years, and may continue to do so for ever, if it is managed with proper attention and care.

## I

description of the Low Countries. His words are these.

*“ Sonien e in Brabante, vicino a Brusselles a un’ tiro d’artiglieria, et si distende verso il mezzo di, in sino a Briene Alleud, et a Briene le Chasteau per ispatio di tre leghe; bosco veramente grande et magnifico, in tanto che contiene di circuitu piu di sette leghe, cio e otto mila bonieri di terra; ciascun’ boniere contiene quattrocento misure, et ogni misura venti piedi Romani; et secondo l’ordinario et uso del paese, se ne taglia ogn’anno per cento bonieri, che rendono al re intorno a cinquanta mila fiorini, cio e venti cinque mila scudi l’anno; et cosi in capo a ottanta anni, il bosco vien’ tutto tagliato, recresciuto, et rennovato come prima, con grandissimi et grossissimi alberi d’ogni sorts. Descr. delle paesi Bassi.*

p. 33.” Which in English runs thus. “ Sonien is in Brabant, about the distance of a cannon-shot from Brussels, and stretches towards the south, as far as to Briene Alleud, and Briene le Chateau, for the space of three leagues. This is a wood really great and magnificent, so that its circumference comprehends more than seven leagues, that is, eight thousand bonieres of land; every boniere contains four hundred measures, and every measure twenty Roman feet; and, according to the use and custom of the country, there is an hundred bonieres of this wood cut every year, which brings

I shall not add further to the length of this letter, but just to observe, that if any one shall find it most convenient to cut his wood by way of *copse*, once in fifteen or twenty years, it will always be proper to leave a few of the most thriving trees at considerable distances from one another, for large timber, and in general the *oak* will be the most proper for this purpose; for although no tree does worse to be left thin when very young, yet when it

in an yearly revenue to the king of about fifty thousand florins, or twenty-five thousand crowns; and hereby, at the end of eighty years, the wood is cut, grown again, and renewed as at first, with very tall and great trees of all sorts."

I have computed the Roman *scudo* to be worth about 5s. 1d. sterling; so that the 25,000 *scudi* will amount to something more than 6,350 l. sterling. This calculation was made about two hundred years ago, before the wealth of the Indies had circulated through Europe, and reduced the value of money; so that this 6,350 l. may be reasonably supposed to have been at that time equal to near three times that sum at present; from which computation, instead of having said in the text 6,500 l. I would have been much nearer the truth to have called it 18,000 l. sterling.

has



has arrived at any considerable size, it resists the tempests, and continues to thrive in this situation beyond almost any other tree. And as this is a wood of such value when full-grown, and of such essential service for the royal navy, it ought on no account to be neglected or despised.

AGRICOLA.

LETTER

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LETTER THIRD.

*Observations on the Fir-tree, and its Varieties.*

*The Nature of the Soil best adapted for  
rearing these.*

S I R,

**I**N my last I recommended the *fir* as the most proper tree for thickening plantations, with a view to shelter other trees from the hurtful effects of wind: but it is proper here to observe, that the kind commonly called *Scots fir*, does not prosper on every soil, and therefore cannot be recommended on all occasions.

The soil in which this tree thrives best is a dry sand or gravel, and it never prospers

spers upon a stiff clay; nor can it be kept alive in any situation where the roots are much exposed to moisture of any kind, which is the cause of that languishing state in which we see so many plantations of this kind of trees; especially upon flat ground, where the bottom has any tendency to clay. For as these plantations are usually made upon barren and uncultivated spots, where there are many small inequalities, which prevent the water from running off with freedom, and the clay below not suffering it to percolate through the soil with facility, it is there detained, and produces upon the surface a light spongy kind of soil, always soft and moist, upon which this kind of trees do never prosper; but as there are many different degrees of this evil, the trees are seen in as many different degrees of health. Sometimes they can never be made to grow at all, but perish as soon as planted. Sometimes they

they advance a few feet high at first, in a languid sickly condition, and preserve, for a short time, an appearance of life, without making almost any progress at all, and at length die away slowly, beginning at the top, and gradually descending to the root; and on some occasions they grow to a tolerable size, but never have the appearance of sound health and vigour, having their trunks always covered with moss, the wood being soft and spongy, exceedingly brittle, and of little value, and the trees themselves of no great duration, quickly falling to decay, unless the owner takes care to prevent it, by felling them very early.

As this never fails to be the case when the soil is of the nature that I have described, let every person of sound judgment, who intends to make a plantation, carefully observe if his soil be of this kind, and be directed accordingly.

Whether



Whether any other of the coniferous trees would prosper in the soil in which this kind languishes, I cannot say, as I never have had sufficient experience of these to enable me to draw any conclusions relating to this; but I think it highly probable, that some of them might answer in damp ground; especially that kind sent to us from North America, by the name of *swamp pine*, as it is probable that they have given it this name from its having been observed to grow in swampy ground.

It would be a subject well worthy the attention of men of fortune to try all the different kinds of trees in every different situation, and observe which kind prospered best on every different soil, and publish their observations from time to time, either in a work on purpose, or in a miscellany such as your own, in which any single observation might be inserted without trouble, and preserved without discover-

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ing the author, if he so chose: And I am disposed to think, that if mankind had followed a plan of this kind, many essential improvements might have been made in many branches of knowledge; as it often happens that one man acquires a considerable knowledge in one particular subject, and another at a considerable distance may have made considerable discoveries in another, both of whom die, and the knowledge which they had acquired by experience dies with them; whereas, had each of these communicated their observations to the public, they would not only have improved each other, but also have transmitted their knowledge to many others, who might never have thought on the subject without being thus prompted to it.

It is but of late that the inhabitants of any part of Europe have bestowed any attention to the cultivation of trees; for  
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as all the northern parts of it were originally over-run with wood, it long required the industry of our forefathers, rather to free themselves from being encumbered by it, than to be under any necessity of rearing it with care. But as mankind have encreased, and the number of domestic animals along with them, the old trees have been gradually cut down, and the young have been prevented from springing up, which has made the woods gradually decrease, without being perceived by the inhabitants; so that in many places the want of wood has been felt before the inconveniencies that would arise from that want have been foreseen; and it was not till mankind had felt these inconveniencies in a strong degree, that they began to propagate trees by art.

Several nations, however, have been obliged, long before this time, to take this method of supplying themselves with fuel,

and many other necessaries of life. But, as was most naturally to be expected, every country has cultivated only those trees which were naturally produced in it, the seeds of which could be more easily procured than any others; and, whether these trees were more or less valuable than others, which might have been equally proper for the soil or situation, seems to have been but little attended to.

This seems to be the only reason why the *Scots fir* is so generally propagated in this part of the world, although it is a plant of a more unsightly appearance, yields a wood of less value, and is more difficult to rear than almost any other of the *coniferous* tribe. However, as the seeds of this tree can be met with every-where, and procured at a much smaller expence than any other kind, it ought not at present to be neglected, as it may answer the purposes before mentioned, till the other kinds can  
be



be also procured at a reasonable price; but all the other kinds ought also to be attended to with care; and where-ever any of these trees are become so large as to carry seeds, these seeds ought to be gathered and sowed, as the plants raised by this means would come almost as cheap as the others.

Which of all this class of trees is the most valuable, is perhaps at present difficult to say; as there are few people sufficiently acquainted with all the different kinds; but it seems to me probable, that, of the tribe of *firs* properly so called, the one known by the name of *silver fir*, having short thick leaves resembling those of the yew-tree, of a dark green on the upper surface, and white underneath, bids fair to be ranked among the most valuable of this class; and next to it, that kind commonly sold by our nursery-men under the name of the *spruce fir*, and  
known

known in some parts of the country by the contradictory name of *pine-fir*; as it is more than probable, that it is the one or the other of these trees which affords the fine deal brought to us from Riga, Dantzick, Norway, &c. and never that kind of tree that we commonly propagate here, which seems to afford a wood of a much inferior quality on all accounts.

My reasons for believing that this is not the tree which affords the fine deal, are as follow,

The wood which is imported from abroad is on all occasions so much superior to our own, as could hardly be the case if it were entirely owing to the nature of the soil, as is generally imagined; for it is not to be supposed, that, in the vast tracts of country on which these trees grow from which we are supplied, there should not be a great diversity of soils, some of which could hardly fail

fail to be of a nature similar to our own, and produce wood of the same quality; neither is it to be supposed, that among the infinite variety of soils throughout this island, upon which these kind of trees have been reared, not one should have been found of the same quality with any of those in the countries where the wood we import is reared; and yet it is a fact well known to every one acquainted with these affairs, that the very best of the wood reared in this country, only approaches to the quality of the very worst that is imported; the small spars sometimes brought from Norway being of a harder and tougher quality, and containing a larger proportion of red wood, and more distinct from the blue, than any of our own produce; which duly considered, gives at least some room to believe that they are different.

I am still the more confirmed in this  
opinion

opinion by the testimony of the bishop of Bergen, who in his history of Norway takes notice, that there are two kinds of *coniferous* trees which spring up spontaneously in that country, the *fir* and *pine*; that the first is preserved with great care, as it affords that valuable wood which they export in abundance; but they take every method they can think of to destroy the young pines, as the wood of these are of little or no value. Now, although he has not given us such an accurate description of either of these, as to enable us to know which species of either of the two genus's he has there mentioned; yet as it is well known that the tree which we falsely call *Scots fir*, is really a *pine* \*, we are sure that it cannot be *it*

\* The botanical distinctions by which the *fir*, the *pine*, and *larix* are known, are these: The leaves of the *fir* come out from the branches singly; those of the *pine* are united where they come from the branch, sometimes two, three, four, or five leaves together; the leaves of the *larix* stand in great clusters upon the branches.

that



that they cultivate ; and as it is certain that the kind of *pine* which we call *Scots fir* is found in Norway, it affords a sort of presumption, that this may be the very kind which they so industriously destroy.

And I am still more confirmed in this opinion, by having once seen a few small spars which had been put into a ship from Riga, for the sake of stowage, with the bark on them, which plainly discovered them to be of one of the two kinds of fir above mentioned, and not the *Scots fir*; the bark of which is very different from either of these two.

Such are the reasons which induce me to believe that our common fir is different from the tree which produces the fine deal; which, although they do not amount to a full proof, might at least be sufficient to induce us to examine this subject with greater attention than has hitherto been done. And as it is an easy matter to get a

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branch

branch with the leaves and cones upon it from the countries where the fine wood grows, we might soon be satisfied as to the kind of tree which produces that wood by this means. This I have just now done, having written to several places for that purpose, and shall not fail to communicate to the public the result of my researches: but lest I might be disappointed or deceived by any accidental mistake, I would be glad if any other gentleman of public spirit, who may read this, would do the same; that, by comparing our observations together, any mistake which might proceed from the ignorance, inattention, or chicanery of those who are employed to procure these specimens, might have the better chance of being detected.

And as there are other uses to which the *pine* and *fir* may be applied, such as making tar, extracting rosin, turpentine, &c.  
some

some species of which afford more of these substances than others, it would be of much real benefit to the nation, if such gentlemen as have an opportunity, either by means of correspondents abroad, or in the course of their travels, would take the same method of ascertaining the particular species of any of these trees which is most esteemed at those places where any of the manufactures above mentioned are carried on; that by this means any gentleman, whose ground was so situated as to be more properly adapted for one or other of these manufactures, by knowing the kind most proper to plant for that purpose, might prepare for it with the greatest advantage. As there is no place where there are a greater variety of substances extracted from the *pine* than in the province of Guienne in France, in the neighbourhood of Bourdeaux, where they extract from it rosin, Burgundy

pitch, turnpentine and its oil, tar, pitch, lamp-black, charcoal, &c. it would be of consequence to discover which kind of this class of trees is there most esteemed for each of these particular purposes. The same might be said of Provence near Toulon, of Tortosa in Spain, and throughout the greatest part of the Swiss Cantons; in all which places much use is made of the different kinds of *coniferous* trees. But there is one tree of this tribe, the *larix*, about which we can commit no mistake, which, for its beauty and utility, deserves to be much more cultivated than it is in this part of the world. But as I have already swelled this letter to too great a length for your Miscellany, I shall defer my remarks upon this tree till another occasion.

AGRICOLA.

[The



[The following answer to this letter appeared in the Weekly Magazine, June 6. 1771.]

S I R,

“**Y**OUR correspondent AGRICOLA appears so sincerely desirous to instruct and be instructed, that, finding myself qualified, by a long residence in the country from which our best wood is imported, to correct some of his mistakes, and give him the information he desires, and deserves, concerning the Scots fir, at his invitation, I send you the following particulars, which you are at liberty to publish, if you think fit.”

“The best red wood imported from the eastern countries is actually the produce of the tree known all over Scotland by the name of the *Scots fir*; and the white wood, which is more open in the grain, and of much inferior quality, is the produce of  
the

the spruce-fir. I shall give your correspondent some reasons for the prodigious difference which he observes betwixt the red wood, and the produce of the same tree in this country."

"AGRICOLA well observes, that sand or gravel is the only soil for this tree. Gravel is by far the best: but he is mistaken in supposing, that in these countries there must be a great variety of soils. The soil is all much the same, thin and gravelly; I mean the soil which spontaneously produces these trees; and they as naturally and invariably chuse that kind of soil, as willows and allers chuse the wet marshy grounds. Besides, these firs being the natural produce of the soils fittest for them, there is another reason for the superior excellence of their wood, which is the slowness of its growth, and the great age the trees live to: instead of being upon the decline at about sixty years old, as in our plantations,

plantations, in Sweden and Norway they are in full vigour at a hundred and twenty; the young wood is always full of knots, which wear out by length of years; and the slowness of the growth brings the wood to a firmness and consistency very different from ours, which soon rushes up, and proportionably decays as fast: this slowness of growth is to be attributed, not only to the poverty of the soil, but to the luxuriance of the branches, which are never lopped off, the pernicious practice of pruning fir-trees being altogether unknown in these countries."

"That the whole difference betwixt our own wood and the fine foreign wood, is occasioned by the one being planted and pruned, the other spontaneous and untouched, is proved by some fir-wood, which I have seen brought from Braemar, at the head of the river Dee, equal, if not superior, to any of the foreign red wood."

"But

“ But as the natural wood is almost wore out of our country, let us, conformably to the views of AGRICOLA, do the best we can to supply its place, and chuse the best soil we can get for planting; and even where the soil is not of the very best, give them as fair a chance for turning well out as it will admit of: In this we should surely imitate the practice of the Swedes and Norwegians, in never pruning our Scots firs, but carefully weeding or thinning them at a proper age, which is a culture they bestow on their firs, but think it not worth their while to take the same trouble about the pines. We must plant thick, that the young trees may shelter one another. As they advance, we find them crouded; and, to give them room, we prune them up, lopping off several tire of branches. This not only weakens the trees, by bleeding them, but makes them rush up very fast; so that, as  
Mr



Mr Rousseau observes of some plantations in France, they are not woods, but forests of masts. Out of a mistaken frugality, we do not chuse to weed them, till they are of such a size that they will sell for spars, or some such use; by which means they are almost wholly destroyed; for the roots having got no room to spread, when the wind gets in amongst them after weeding, they are not able to bear it. This is a mistake so generally given into, whether from ignorance, inadvertency, or a thirst of too hasty gain, that I cannot take a ride any where, but my heart is sorry to see numbers of (otherwise thriving) young plantations, all languishing and going to ruin, from this very error; and I am very happy to take an opportunity, through your means, Mr Printer, of warning my countrymen against it. I am, S I R,

Your humble servant,

Shire of Angus, May 25. 1771.

SILVIUS."

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82 OBSERVATIONS

[This produced the following answer,  
July 4. 1771.]

S I R,

I AM happy to think, that the observations I have sent you on planting, may perhaps be the mean of inducing some more able pen to treat of that subject, and to furnish the world new rules relating to it, founded on experience, the only sure road to knowledge. Many men, as I already observed, do every day acquire a degree of skill, in some particular art or science, far beyond that which falls to the share of the ordinary part of mankind; and, as these are often too much engaged in business to think of writing, or have made too few original discoveries to furnish matter for a new publication, the superior degree of knowledge which they have acquired is never communicated to the world, but dies with the original possessor,

seffor, and the public receives little benefit from their discoveries. There appears to me to be no method so well calculated to induce such persons to communicate their knowledge to the world, as for some person of ordinary parts to write a few familiar miscellaneous essays on different subjects, and publish them in some amusing periodical work, like your's. For as these essayists may frequently treat, in an imperfect manner, a subject which some other person who reads it may feel he understands more thoroughly, in several important respects; this will naturally make him desirous of correcting the faults, or rectifying the mistakes of the writer. And as he can do it with the utmost facility, without formally writing a book, or being invidiously criticised as an author, he will readily communicate to the public his own more valuable discoveries. It was in a great measure with this view

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that I at first sent you a few remarks on planting; and it will be with the same design that I shall continue to communicate some other observations on this subject, till I have brought under the view of your readers the principal circumstances relating to it, which it is of importance for them to know; and the sensible observations of your correspondent SILVIUS; give me room to hope that my views will not be entirely frustrated. One observation, founded upon actual experience, is undoubtedly worth five hundred plausible theoretical conjectures, and will ever be so estimated by the ingenious inquirer after truth; so that I shall not deem the little pains which I have bestowed upon this subject as thrown away, seeing it hath induced SILVIUS to write, and may perhaps be the means of bringing others to follow his example. Desirous of acquiring knowledge on every useful subject, I receive it  
with



with pleasure, from whatever hand it may proceed. Attached to no theory, and having no favourite system to support, I follow Truth where-ever I can perceive her, in whatever dress she may appear, without regarding who it is that may present her, or in what manner she may be introduced; and if at any time Error should assume her amiable appearance, and be incautiously cherished in her stead, I shall ever esteem as my friend that man who shall discover the deceit, and push the secret enemy away. From this principle, I desire that SILVIUS will accept my hearty thanks for the information that he hath given me concerning the Scots fir: but, as the mind cannot easily, and never ought to acquiesce in the belief of any thing as a truth, while any objections of seeming force remain against it, I could have wished that he had been a little more explicit than he has been upon one point  
that

that he treats of, as I apprehend that it might lead to errors in practice, unless it were more fully explained than he hath as yet done. And although I, who have bestowed more attention on this subject than some others may have done, have little difficulty about the manner in which it ought to be understood; yet as the bulk of mankind are naturally indolent, and seem to avoid exerting the faculties of the mind, by not pursuing, with a due degree of attention, any serious disquisition, as naturally as they shun any severe bodily labour, seldom talking more of either than is barely sufficient to amuse, unless when compelled by necessity, they are too apt to take the words of a sensible writer in a more strictly literal sense than they ought, even in cases where a small degree of reflection might convince them of their error, and which the writer perhaps deemed so very obvious, as to think  
it

it unnecessary to enter any caveat against; and much more so in cases of a dubious nature. Possibly your ingenious correspondent may not have sufficiently attended to this circumstance;—or I may be mistaken. When he has read the following observations, he will be in a condition either to rectify my mistake, or prevent the errors in practice that might have arisen from his former observations.

SILVIUS rightly observes, that many of our plantations in this country are hurt by injudicious pruning; and still more by a neglect of thinning at a proper age. Surely nothing tends more to promote the health of trees than a due proportion of fresh air, properly admitted to them; without which it is probable that no tree whatever can attain that degree of sound vigour which is necessary for the formation of firm and lasting wood. A due proportion of branches is likewise necessary  
to

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to pump up the juices from the roots,—to distribute the nourishment in right proportions to every part of the tree, and to allow the superfluous moisture to be freely perspired by the leaves. But whether it is always hurtful in every situation to prune any kind of fir-tree, (as the expressions of SILVIUS would naturally lead us to suppose), seems to me extremely doubtful, for the following reasons.

It is now clearly demonstrated, from the experiments of Bonnet, Du Hamel \*, and others, that trees encrease in bulk, not by a gradual extension of the parts, as is usually the case with animals, but by an annual increment of new parts added to those which have been already formed; so that, after a tree hath finished its growth for a season, the shoots, which had been produced at the top and at the extremities

\* Particularly in his *Physique des Arbres*.



of the branches, never afterwards extend any farther in length, but for ever remain fixed as a basis, from which new shoots may afterwards proceed. In the same manner the ring of young wood, that is formed upon the outer surface of the trunk and branches each year, which constitutes the annual increase in diameter, after the growth for that season is over, never encreases in dimensions, but ever remains of the same size, having a new ring of young wood applied above it next year, which also remains fixed as the former.

All these particulars are plainly perceived by the transverse cut of any tree whatever; the age of which may be distinctly known by the number of fibrous rings of which it consists. And if it be sawed longitudinally, the fibres are as easily perceived in many trees, particularly the fir. It is a longitudinal section of these annual

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rings



rings which constitutes the threads so distinctly perceptible in every deal whatever.

The structure of the branches is exactly similar to that of the body of the tree. And as these, in every species of coniferous tree, must always take their rise at the very heart, usually branching out all round the stem nearly in a horizontal position, it necessarily follows, that wherever a branch springs out from the trunk, there the upright fibres of the body of the tree are obstructed, and are bent outward nearly at right angles from the others; so that when the body of a tree is sawed longitudinally into planks, at every place where a branch has sprung from the tree, the fibres of the branch are cut transversely, which has a very different appearance from the rest of the wood, and forms the irregularity in deals that we call *knots*.

This being the case, it is obvious, that,

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at every place where a branch springs out from the trunk of a tree, there must be a knot in the wood; which will extend the whole way from the centre to the circumference, however great the diameter of the tree may be, if the branch was on it when the tree was felled. But if a branch be cut from the tree while it is growing, the stump from that time ceases to advance in size; and as the diameter of the tree continues to encrease, the cortical fibres gradually cover the wound;—it is soon healed up; the bark at that place becometh smooth, and the rings of wood are formed with as great regularity above the old stump as in any other part of the tree: So that when this is afterwards sawed into planks, there will be found at every such place a knot in the heart of the wood, which will extend to the same distance from the centre of the tree, as was its semi-diameter when the branch was cut;

but all beyond that to the circumference will be uniform, and free from knot or blemish of any kind whatever.

As all these are facts which cannot be contested, about the truth of which it is in the power of any one fully to satisfy himself whenever he pleases, by examining with attention any tree of this kind which may be in his way, it is evident, that if we could suppose it possible to find a *fir-tree*, which had retained all its branches from the first shoot that it had made to the last period of old age, the trunk of it could be nothing else but one great congeries of knots; so that the continuity of the fibres being broke off at the end of every year's growth, it would be unfit for any purpose where strength was necessary, and in a great measure useless for every thing else. But if these branches had been taken away from the body of the tree when it was but of a small diameter, the



the wood which had been formed by the encrease of the tree after that period, would be of an uniform texture, free from knots and flaws, and well fitted for carrying burdens, or for any other purpose.

From this view of the matter, it would seem, that if nature doth not spontaneously throw off the branches after a certain period, judicious pruning must be of the greatest consequence to assist in the formation of good and perfect wood of coniferous trees.

What may be the case in countries which are more favourable to the growth of this kind of trees, than our own is, I cannot say; but I am well satisfied that some assistance in this respect is of very great use on many occasions in this country, as will, I believe, appear evident to any one who shall take the trouble to examine if the following observations relative to this subject are just or not.

The

The fir-tree does not, like many other trees, send out branches irregularly, and of very different sizes, some of which at least equal, if not exceed the principal stem; but at the beginning of every year's growth a good many branches are sent out all round the stem, many of which the first year are little smaller than the principal stem itself. These continue to encrease in size each year for a considerable time. But as the sap in all trees naturally ascends with the greatest vigour to the parts of it which are most upright; and as these branches are nearly horizontal, a greater proportion goes to the uppermost stem than to any other part: So that this, and the parts of the tree which are nearest to it, grow with a greater degree of vigour than those which are farther removed from the top. And as the top of the stem advances upwards, and recedes farther from the first formed branches, these gradually

gradually receive a smaller share of nourishment, and each year make smaller progress in their growth, till at last they stop entirely,—continue a few years upon the decline, and gradually die away.

This is the natural progress of the fir-tree, which I apprehend must take place more or less in every situation; although the number of growing branches will always be greater where they have room to spread freely on every side, than where they are more confined; and the wood, for the reasons above enumerated, never can be good but where the trunk of the tree has been free of branches for a great number of years.

How long time it would take for a tree spontaneously to free itself of its dead branches, I cannot pretend to say; but it could not be effected in a short period, seeing it can only be produced by the gradual decaying of the branches, which  
would

would fall away in proportion as they rotted; to effect which entirely must require a great many years, as some of the branches are of a considerable size, and consume but very slowly. Now, as these branches continue to form knots in the wood during the whole time that they adhere to the tree; and as they *cannot* be of the smallest service to it in any way after they are dead, but, on the contrary, *must* be of considerable detriment to the wood; it would seem to be a branch of culture extremely necessary, to lop off all these close by the stem, as soon as they were dead at least; and it does not appear quite clear, but that, in many cases, it might be an advantage to the wood even to prune off some of the living branches, or those which shewed evident marks of decay.

Although I agree entirely with your correspondent about the great utility of  
early



early thinning, and am by no means an advocate for that *excessive* pruning which he seems to reprehend; yet as I have at present before my eyes a most convincing proof of the great loss arising from the total neglect of this necessary branch of culture in a wood, the trees of which are, indeed, of almost no value at all from this cause, I thought the above caveat was necessary: I must likewise add, that the finest young fir-wood that I ever saw in Scotland, was reared by a gentleman, who was exceedingly careful to prune his trees every year; but he was a judicious man, and took care not to over-do. The nature of the tree, and the uses to be made of the wood, absolutely require that it should have the disagreeable appearance, when growing, that Mr *Rousseau* complains of; and it would be but a very indifferent mast indeed, which had not had

a naked stem for many years before it had been felled.

Let the reader carefully remark, that I here speak only of the *fir-tree*. The manner in which branches come out from the stems of other trees; their way of growing, as well as the effects they have upon the wood being very different from these, they require a very different treatment from the above. And although I am not fully satisfied that the great number of branches will tend to make the trunk encrease more slowly; yet as this is but a matter of mere speculation, and this letter is already too long for your Miscellany, I shall not at present take up your time by insisting any longer upon that head: But if none of your correspondents chuse to favour us with any remarks upon the effects of branches on the growth of *deciduous* trees, and the proper method of pruning these, I may perhaps, on some future

future occasion, be tempted to throw out some hints relating to that subject, to see if I can induce them to communicate to the world any discoveries they may have made relative thereto.

AGRICOLA.

[This produced the following answer.]

S I R,

**I** Should long before now have replied to the queries and doubts of AGRICOLA, concerning pruning of fir-trees, suggested by him in consequence of my indiscriminate condemnation of that practice. This gentleman's accuracy, zeal, and attention to instruct the public in several branches of real use and importance, deserves all possible regard to be shown to whatever he throws out; it was only a sense of how little I had to advance

conclusive upon the subject, that has rendered me backward in offering it; and I still submit it to you, Mr Printer, whether what follows is of consequence enough to take up a place in your paper.

“ As what AGRICOLA advanced in favour of pruning fir-trees, appeared to me to carry a great deal of weight and reason along with it, I would not depend on my own memory or opinion for settling the point; but having an opportunity at hand, I applied to a native of Wermerland, which produces the best fir-wood in Sweden, above two hundred miles from the coast; he is a sensible fellow, and very capable of giving information about a place which strangers can know little of.

“ Upon asking him if they ever pruned their best fir-wood, he told me with a smile, it was absolutely impossible, on account of their extent, and, as he thought,  
quite



quite unnecessary, as they always pruned themselves; that all they could do where they expected the best wood, was to hew down the weakly and over-topped, to make room for the rest, and that even this thinning was but very superficially performed; he allowed it would be much for the advantage of the remaining trees, if this were done to better purpose; but the low price, and immense extent of the woods, forbid it. Whether they would be the better for pruning, my Swede could not say, as it is a thing he had no experience of; but it was his opinion, that the great difference in quality betwixt our wood and theirs, was chiefly owing to the great age of the trees in Sweden, as he had observed, that if they were cut too early, the deal was always knotty, and very open in the grain.

“ Upon inquiry, I also find, that the best fir-wood in Scotland, produced by nature  
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in the Highlands, is never pruned ; so that in these points experience contradicts the theory of AGRICOLA ; though I must own, to me it appears as reasonable as it is ingenious and accurate : here we find, that in spite of the annual production of a whole row of horizontal branches, each of which forms a knot in the parent tree ; in spite of the length of time that these branches remain before they fall off, and the rough ragged stumps they often leave behind, the tree is actually filled up, and covered by new coats of wood, and the deal is found to be as free of knots as can be wished.

“ Still it must be considered, that the trees we speak of in Wermerland and Braemar, are Nature’s favourites, children of her own, to whom she shows that kindness which we cannot expect her to extend to those whom we force her to adopt : therefore it remains with me doubtful, whether  
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in our more weakly plantations pruning as well as thinning may not, if judiciously performed, be a proper help and culture for them ; but under this limitation, which, in my opinion, it is absolutely necessary to observe, of never touching a branch till it shows evident symptoms of decay ; for the mischievous consequences of making them rush up too tall, and of bleeding them, by wounding the green resinous wood, is very apparent. Your's, &c.

*August 3. 1771.* SILVIUS."

As the matter in agitation is still left a little doubtful, I shall use the freedom to transcribe a very sensible account of the Scots pine by James Farquharson of Invercauld, Esq; published in the Philosophical Transactions, which will remove every difficulty that remains on this head.

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“IT is generally believed that there are two kinds of fir-trees, the produce of Scotland, viz. the red or resinous large trees, of a fine grain, and hard solid wood. The other, a white-wooded fir, with a much smaller proportion of resin in it, of a coarser grain, and a soft spongy nature, never comes to such a size, and much more liable to decay: At first appearance, this would readily denote two distinct species; but I am convinced that all the trees in Scotland, under the denomination of Scots fir, are the same; and that the difference of the quality of the wood, and the size of the trees, is entirely owing to circumstances; such as the climate, situation, and soil they grow in. The finest fir-trees appear in the most mountainous parts of the Highlands of Scotland, in glens or on sides of hills, generally lying to a northerly aspect, and the soil of a hard gravelly consistence, being  
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the natural produce of these places; the winged seeds are scattered in quantities by the winds, from the cones of the adjacent trees, which expand in April and May with the heat of the sun; these seedings, when young, rise extremely close together; this makes them grow straight, and free from side-branches of any size, to the height of 50 or 60 feet, before they acquire the diameter of a foot: Even in this progress to height, they are very slow, occasioned by the poorness of the soil, and the numbers on a small surface, which I may say makes them in a constant state of war for their scanty nourishment, the stronger and tallest by degrees overtopping the weaker, and when the winds blow, they lash against one another; this assists in beating off any horizontal branches that might damage the timber with knots, as well as by degrees crushes the over-topped trees. In such a state of

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hostility they continue struggling, until the master-trees acquire some space around them; then they begin to shoot out in a more bushy manner at the top, gradually losing their spiral form, encreasing afterwards more in size of body than height, some acquiring four feet diameter, and above sixty feet of height to the branches, fit for the finest deal-boards. The growth is extremely slow, as is plainly proved by the smallness of the grain of the wood, which appears distinctly in circles, from the centre to the bark. Upon cutting a tree over close at the root, I can venture to point out the exact age, which in these old firs comes to an amazing number of years. I lately pitched upon a tree of two feet and a half diameter, as this is near the size of a planted fir of fifty years of age mentioned, and I counted exactly two hundred and fourteen circles or coats, which makes this natural fir above four times

times the age of the planted one. Now, as to planted firs, these are raised first in dressed ground from the seed, where they stand two seasons, or more, then are planted out in the ground they are to continue in at regular distances, have a clear circumference round them for extending both roots and branches; the one gives too quick nourishment to the tree, which shoots out in luxuriant growths, and the other allows many of the branches to spread horizontally, spoiling the timber with knots; besides, this quick growth occasions these thick yearly circular coats of wood, which form a coarse grain, of a spongy soft nature. The juices never after ripen into a proportional quantity their resinous preservative balm: So that the plantations decay before the wood acquires age, or a valuable size, and the timber, when used in work, has neither strength, beauty, nor duration. I believe

the climate has likewise a great share in forming the nature of the best wood; which I account for in the following manner: The most mountainous parts of the Highlands, particularly the northerly hanging situations, where these fine fir-trees are, have a much shorter time of vegetation than a more southerly exposure, or the lower open countries, being shaded by high hills from the rays of the sun, even at mid-day, for months together; so that, with regard to other vegetables, nature visibly continues longer in a torpid state there than in other places of the same latitude. This dead state of nature for so long a time yearly appears to me necessary to form the strength and health of this particular species of timber. No doubt they may at first show a gratefulness for a better soil and more sun, by shooting out spontaneously; but if the plant or tree is so altered by this luxury that it cannot



cannot attain any degree of perfection fit for the purposes intended, the attempt certainly proves in vain.

“ From what is said above, it is not at all my intention to dissuade from planting Scots fir, but to encourage those that have the proper soil and situation to do so, being of opinion, that where these circumstances agree, and there planting, not in lines, but irregularly, and thicker than common, the trees will come to be of equal size and value with the natural ones. In confidence of this, I have planted several millions on the sides of hills, out of reach of seed from the natural firs.”

There was never perhaps penned a plainer, more concise, and satisfactory account of the nature and growth of any tree, than is contained in this very short extract: at least so it appears to me.

By attending to it, we see the reason  
why

why natural fir-woods, although not pruned, are quite free of knots, as they necessarily prune one another before the side-branches attain any considerable thickness.

But if fir-trees are planted at such a distance from one another as to allow the side-branches to grow till they attain a considerable degree of thickness, there can be no doubt that the wood must be knotty throughout its whole length; so that, in these cases, clean wood cannot be expected but where the trees are regularly pruned every year, so as to leave only a small top with branches on it.

If this account be just, we ought also to doubt if the thinning recommended by SILVIUS would be attended with the benefits he seems to expect from it: for although it might probably make the trees advance more quickly, it would also make the wood be of an inferior quality.

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There would likewise be danger that if this was done at an early period, while the trees continued to advance in height, there would be a necessity of pruning them after they were thinned, to prevent the wood from becoming knotty and foul. On these accounts, where fine wood is required, it is perhaps best to leave the wood entirely to itself.

But where the view of the proprietor is to obtain large trees in a short time, without regard to the fineness of the quality of the wood, he will best succeed by planting the trees at such a distance from one another as to allow them abundant nourishment, if the situation is so well sheltered as to admit of this. But in these cases there will be a necessity of pruning the trees regularly, otherwise the wood would not only be full of knots in every part, but the trees would taper so much towards the top as to render it of little value

lue for those uses to which this timber can be properly applied.

It is found by experience, that thinning a plantation of pine or fir trees, unless when they are very young, and covered with branches almost close to the ground, is always attended with very great danger. So long as they continue to grow close by one another, with the branches of their tops intermingled with each other, every tree gives and receives support from those around it: but when this support is taken away, by felling out any of the trees, the wind acts with such force upon the top, which is at such a distance from the root, and is supported by a tall and feeble stem, as necessarily either breaks it over,—tears it out by the roots, or warps it so much as to cause it languish ever afterwards, and die altogether in a few years. To avoid this inconvenience, it is perhaps always adviseable to leave a plantation of conife-

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rous trees untouched, till the time it is intended to be felled altogether,—and then to cut clean out at once as far as you intend to go. It is even doubtful if it is proper to cut down those trees that die by the overshadowing of the others, unless where they are entirely overtopped.

We see many plantations of pine-trees in Scotland, where the whole bark of the trees are encrusted with fog,—and the trees in a languishing condition. This is often ascribed to the thickness of these plantations, which excludes the air from them; but it is always owing to the nature of the soil. A thousand plantations of pines are made in Scotland on soils upon which this kind of tree will not thrive, for one that is made on a proper soil:—So it is not surprising, that, in these circumstances, we should frequently meet with plantations of sickly trees of this sort.

If ever we hope to have success in planting

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timber,

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timber, let us not be so unreasonably attached to the culture of one tree, as to exclude all others;—and let us never forget, that the common pine-tree, called *Scots fir*, will not live almost at all on a clayey soil,—does not prosper on a loam,—and is only seen to thrive upon sand or firm gravel, which is allowed to be the soil it most affects.

I now proceed to take notice of some other kinds of trees.

LETTER

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LETTER FOURTH.

Of the Larch-tree;—The valuable Uses to which it may be applied;—Manner of obtaining its Rosin.

S I R,

May 30. 1771.

ALTHOUGH the *larix* is not a native of Britain, yet the lively verdure of its foliage, and the elegant figure of the whole plant, has recommended it to the attention of our countrymen as an ornamental tree, although it is not as yet become so common as to have its value, as an useful tree, sufficiently known. But in *Italy*, in *Carinthia*, and the country of the *Grisons*, and throughout the whole extent of the *Alps*, where it grows in great

abundance, it is esteemed the most valuable tree that they have: and it is there valued for so many excellent qualities, that I cannot help recommending it, in the warmest manner, to the attention of my countrymen.

We ourselves have daily proofs before our eyes, that few trees advance so quickly as this does: and the testimony of all travellers invariably agrees in asserting, that it thrives in the poorest soil, and most exposed situation, there growing to a prodigious height and magnitude, being often found eighty feet high or upwards, with a trunk perfectly straight throughout its whole length. The wood of this tree is likewise much esteemed for its exceeding great durability, it being almost incorruptible either in the open air or under water; as is clearly demonstrated at *Venice*, the greatest part of which city is built upon *piles* of wood; which are not  
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only still fresh, although they have remained there for many hundred years, but they have at length acquired such a degree of hardness, and in some measure to resemble iron, so as to resist the edge of the best tempered tool.

I need not point out the utility that a wood possessed of this valuable property might be of to a country like this, which depends so much upon its navy for its preservation and well-being, as it promises to be a ready succedaneum for the *oak*, and, for some particular purposes, would seem to be even more valuable than it; for although the straightness of the tree would never allow it to be proper for ribs or knees, yet, for outward cleathing, it might perhaps be more valuable than the *oak*, as it would be lighter and more buoyant, and possibly might resist the worms in warm climates; at any rate, it would not be so apt to splinter during the  
time

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time of an engagement, which would save many useful lives, that are always lost on these occasions by the splinters of the *oak*. Along with these properties, we ought always to remember, that as it is of much quicker growth, we could much more easily supply ourselves with this kind of timber than with *oak*. All which considerations makes it merit the attention of every sincere friend to his country, at least so far as to get a fair trial made, to see whether it would answer all these valuable purposes or not.

But whether it may answer all these purposes or not, it is undoubtedly possessed of other properties which render it well worthy our peculiar care. In the countries where this tree grows in abundance, the common people, on many occasions, make their houses entirely of it, as they are, at the same time, the cheapest and most comfortable habitations that they could

could possibly rear. The walls are formed of square logs placed by one another's sides, kept close to one another by a strong beam going across the top of the whole, the other parts being kept firm by strong pins.

When it is first put up, it appears quite white, but in a short time there oozes forth from the pores of the wood a great quantity of a resinous juice, which hardens by the air, and becomes of a black colour, forming a thick coat of varnish over the whole surface of the wood, which preserves it from the corrosive effects of the air; and as the interstices between the logs are filled with the same varnish, when it dries it cements the whole together, forming one solid body, totally impervious to every blast.

The roof is covered with thin boards of the same wood, cut into the form, and put on nearly in the same manner as slates, and

and by them called *cingles*, which are soon covered with a varnish, and cemented together in the same manner as the walls. This forms the lightest, closest, most durable, and cheapest covering that could possibly be got; and the whole habitation is so neat, so warm, and so secure, as must be extremely comfortable to the inhabitants, very different from what is experienced by the poor possessors of the wretched hovels to be met with in every country of Europe, where they have not the convenience of these materials.

And as it must be acknowledged, that Britain feels no such capital defect in any of the essential necessities of life, as in wanting proper materials for roofs to the houses of the lower class of people; therefore we ought very much to prize any thing which promises to remove this defect. *Slates* are indeed a good covering, but are not only weighty, but come so high



high as not to be within the power of any but the great and opulent to purchase: *Tiles*, although light and tolerably cheap, are so soon wore out, and so liable to accidents from winds, as render them a troublesome and uncomfortable roof.

The only alternative which remains for the poor people besides these, is either *thatch* or *turf*, both of which require such continual repairs, on account of the perishable nature of the materials, — such constant attendance to guard against accidents from wind, and are at best such a poor defence against the inclemencies of the weather, as but ill repays the poor inhabitants for the perpetual expence, and labour, and care, and watching, to which they are continually subjected on this account; not to mention the damage they sustain by the crouds of vermine, to which these at all times afford a ready shelter, or the danger they run of being set on fire

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from every casual accident; all which united, form such a complication of distresses, continually hovering over the head of this class of people, as must have a tendency to damp that lively vivacity of spirit, the exertion of which constitutes the principal happiness of man, and tends to inspire a desponding indifference, which ends in languor, inactivity, and misery. Every humane mind, therefore, must surely feel a sensible pleasure in the prospect of being able to remove these distresses from so many of his fellow-creatures, and bestow a particular attention to the rearing of this tree, which promises to supply these defects.

I had almost forgot to mention, that this wood is reckoned of such a quality as to be almost incombustible, resisting the fire in such a degree, as only to consume in a very great heat extremely slowly.

What credit is to be given to this opinion,

nion, I cannot say; but as it is as old as *Pliny*, and is still believed in the countries where this wood is common, it is probable that there must be some foundation for it; and I am the more inclined to believe that this is the case, from having heard that an *Italian* of some note wrote a book on this subject; the design of which was to persuade his countrymen to use this in some cases as fire-wood; but the only cases in which he recommends it, is for heating furnaces, and other large works; because, says he, when a great quantity of it is put into a well-draughted furnace, it may be made to burn very well: But as he does not say that it could be made to answer the ordinary uses of life in a common grate, I think we may conclude, that from experience he had found it would not burn well in any other circumstances than these he describes.

But, valuable as the wood may be, it is

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not

not on this account alone that the inhabitants of *Italy* prize it so much; they likewise make use of its bark for tanning leather, and from the body of the tree, while growing, they extract that resinous balsam, commonly known by the name of *Venice turpentine*, which yields them a very considerable revenue. The manner of extracting the turpentine is as follows.

The whole of the wood of the *larch*-tree is richly impregnated with this resinous juice, and, when young, it is almost equally diffused through all the parts of it; but as the tree advances in size, there is gradually formed in the body of the wood, especially near the root of the tree, small cavities, which are filled with this liquid rosin, quite pure, and separate from the wood. As the tree grows bigger, these cavities likewise encrease, insomuch, that, when a tree is in full vigour, and of a considerable magnitude, these will sometimes



sometimes be found about an inch in thickness, three or four in breadth, and as much in height.

These cavities are chiefly met with about five or six inches from the heart of the tree; and it is generally observed, that, in the trunk of a tree about forty feet in length, there will be found about six or seven of these principal reservoirs, and a great number of smaller.

When the trees begin to decline, the cavities contract, and afford but little turpentine; for which reason, the workmen seldom chuse a tree that is very young or very old, as neither of these would yield much of this balsam, but prefer such trees as are of a considerable magnitude, and still in high vigour, before all others.

To extract this resinous juice, (if I may so term it), they bore a hole into each tree in the month of March, piercing very near to the heart of the tree, and making  
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the hole slant a little upwards, to allow the balsam which may be collected in it to flow out more easily. To each of these they fix a small tube of wood, at the end of which they hang a vessel for receiving the resin as it flows from the tree. They come to the wood every morning, from the end of May till the end of September, to empty the vessels which are hanging at the tree, the balsam taken from which they carry home, and keep in proper vessels till the end of the season; and when they can obtain no more, they strain the whole through a cloth, and put it in proper vessels for sale.

This is a semifluid balsam, which never hardens in the air, and is commonly sold by the name of Venice turpentine, although it is of an inferior quality to that obtained from the *fir-tree*, which is the only genuine kind. If it is distilled with water, it yields an essential oil, which is likewise

likewise called *oil of turpentine*, although it is also of an inferior quality to that obtained from the fir-tree.

Such is the process for obtaining the turpentine from the *larix*, the profits arising from which must be very considerable, seeing it is generally computed, that a vigorous larch-tree will yield seven or eight pounds of turpentine every year, for forty or fifty years\*.

Besides all these different substances, the *larix* likewise yields a species of *manna*, known by the name of *manna laricea*, or *manne de Briançon*, much praised by the antient historians of Dauphiné. This substance is found chiefly among the Alps, and appears in the months of May and

\* The usual selling price of this resin, I am told, is about 6 d. per pound. But supposing it were only 2 d. the annual produce at the above rate would amount to 1 s. 4 d. or 1 s. 6 d. per tree. — A Scots acre contains 450 trees at ten feet from one another; at which rate, the annual produce would be L. 28 : 2 : 6.

June,

June, in the form of small whitish grains, the young trees being entirely covered by them, so as to be all over white, as if covered with hoar-frost. It must be gathered early in the morning, as the sun dissipates it at his first appearance, as readily as the dew. But as I apprehend that this substance is but of little value, it is hardly worth attending to.

Upon the whole, I flatter myself that the reader will agree with me, in being satisfied that this tree seems to be possessed of so many valuable properties, as to demand, in a particular degree, the attention of our countrymen. That they may be induced to propagate it in greater abundance, and soon feel the good effects arising from that, is the sincere desire of

AGRICOLA

LETTER



**LETTER FIFTH.**

*General Observations on the different Circumstances that ought to be attended to in making a Plantation of Trees in different Situations.*

S I R,

June 13. 1771.

I AM so much persuaded of the benefit which might accrue to the nation in general, as well as the advantage which individuals might reap from planting trees, if it were duly attended to, that I would willingly remove every objection to this valuable improvement that occurs to me. What I have already said may probably obviate some of these; but I am sensible

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that

that there are many others which still remain to be considered; and as some of these at present occur to me, I shall briefly mention them, in order to prevent any young or inconsiderate person from engaging too rashly in an undertaking of this kind, and point out many circumstances relating to this subject, which are of very great consequence, although they are at present never in the least attended to.

It is not on all occasions enough that wood can be made to grow; for if we have not a market for that wood, or some method of disposing of it to advantage, it can be but of very little advantage to the proprietor. As this is a consideration of the utmost consequence, it ought to be attended to with the utmost care, and every circumstance ought to be duly weighed before any considerable plantation is made.

For this purpose, it will not only be necessary

cessary for every one who intends to raise a plantation, to consider what kind of trees are most likely to thrive best upon his particular soil or situation, but also to endeavour to discover which kind will be most properly adapted to the market to which he can bring it. With this view, he ought to attend to the situation of all the objects around, and see what influence they may probably have upon his project; He ought even to pay attention to the *prejudices* of the people among whom he is placed, as these often have a much more powerful effect upon the mind of man than a speculative recluse would be apt to imagine; and, however chimerical these may sometimes be, yet as they often produce very serious consequences in life, they ought by no means to be despised.

The most superficial observer must here remark, that the value of wood of the

same quality must vary prodigiously in different places; but, in general, we must deem those situations particularly favourable which are near any large and populous place; and the man may be esteemed happy in this respect who is situated near a sea-port, or upon a navigable river; or who inhabits a populous country where wood is scarce, and every branch of value: Such a one sets out with great advantages, and can reap profit from every article; but in an inland or mountainous country, at a distance from markets, far from every navigable river, and destitute of roads upon which weighty carriages could pass, of what value would be the *wood* of the finest trees that could be reared? They might stand till they were overturned by the tempest, before any one could offer to purchase them; and their stately trunks, afterwards mouldering in the dust, could only excite a melancholy  
sigh



figh from the passing traveller, without a possibility of making it turn out to any account.

What shall be done in such a situation? Is the proprietor of these places, who, by his situation, must ever be deprived of the power of carrying on any other valuable improvement, likewise to be deprived of every advantage that he might reap from this one, which is so easily within his reach? Must he, by being obliged to give up all hope of reaping any advantage from this, sit down in despair, and drawl out a life of listless inactivity, without being able to exert the animating spirit of industry, of rousing into life the half-extinguished powers of those around him, and of pouring the blessings of vivacity and plenty upon the miserable wretches who are now depressed with poverty, and debilitated with indolence? Hard, indeed, would be the situation of such a one were this

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this the case; but so careful has the beneficent Creator been for the happiness of man, that he has left no climate upon our globe, which does not yield some useful product, nor any soil destitute of vegetables for the comfort of the human race; nor any situation in which the industry of man may not convert the produce of the soil to some valuable purpose for himself and his fellow-creatures,

Although there are many situations in which it is impossible to make any profit of the *wood* of trees in substance, yet as many of these yield some other produce of great value, independent of that, it is impossible to conceive a situation in which profit may not be made of a plantation of trees, as I hope to be able to demonstrate in the most satisfactory manner. If the wood is of no value, it is still in his power to extract from it *turpentine* and its oil, *rosin*, *tar*, *pitch*, and *lamp-black*, which can easily

easily bear the expence of transporting. If it is not proper for these, it may be reduced to ashes, and afford the valuable substance called *pot-ash*. In some situations charcoal may be of use, and in others the bark becomes of great value; and sugar may be extracted in abundance from trees which may yet grow in our most barren mountains; nor is it impossible but the Caledonian hills may yield from their trees a wine not inferior to those which the grape affords in warmer climates.

Some will think that I am now advancing into the regions of romance; but let not any one condemn me, until he has heard the method in which all these and other products may be obtained; and if he then thinks so, I give him full liberty to condemn me.—In the mean time, I have not the smallest scruple to declare, that, by attending to these circumstances I have mentioned, and making a plantation, with a view

view to extract that particular substance from the trees which will be best adapted to the soil and situation of the place; very great profits may be made from such plantations in every part of the island: and, to convince my countrymen of this, I shall perhaps, upon some future occasion, describe the manner in which the most valuable of these substances above mentioned are obtained.

AGRICOLA.

LETTER



LETTER SIXTH.

*On the Fir-tree, and Method of extracting its Turpentine.*

S I R,

June 20. 1771.

I ALREADY remarked, that it is probable that the *silver-fir* is the tree which affords the finest deal. Whether this is really the case, I cannot positively assert; but certain it is, that this tree alone produces the genuine balsam known by the name of *Venice turpentine*; for although the *larix* affords a resinous juice, somewhat of the same nature which is usually sold under the same name, yet it is of a quality much inferior to that which is extracted from the *fir-tree*, and sells at a

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much

much lower price. As this substance is of considerable value, and may in many situations afford the principal revenue which can be drawn from a plantation of this kind of trees, I shall briefly describe the method of collecting it.

The liquid rosin which exudes from this species of *fir-tree*, instead of being lodged in the wood as in the *larix*, is collected in small cavities formed in the bark of the tree, inclosed in a thin film or bag, which, when full, forms softish excrescences upon the surface, easily distinguishable by the eye. These little bags, filled with rosin, begin to appear when the tree is about three inches in diameter; from which time they continue to encrease, and yield every year a greater quantity of rosin, till the tree becomes about a foot in diameter; about which time the bark begins to grow hard and woody, and the cavities become smaller, so as gradually to

to yield less and less after that period.

From this peculiarity in the manner of yielding its juice, we may observe, that it would be extremely proper to plant this species of *fir-tree* along with the *larix*, in those situations where the rosin is a principal object of consideration; because as these trees yield their rosin when very young, while the *larix* only affords its balsam at a more advanced age, a considerable profit might be drawn from them before the *larix* was of such a size as to yield any turpentine; and when the *larix* should advance in size, and require more room, these might be cut out, after they had furnished all the turpentine they could yield.

In order to collect this rosin, the peasants in the north of Italy, where this rosin is chiefly gathered, provide themselves with a small white-iron vessel, wide at one end and sharp at the other, somewhat resembling a horn, with an open kind of

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flask hung by their side, and a pair of iron crampets fixed to the inside of their feet, to strike into the tree to assist them in climbing it. Being thus equipped, they go out every year in the month of August to the woods; and examining every tree with care, where-ever they discover one of these bladders of rosin, they thrust the sharp point of their white-iron instrument into the under part of it, and thus make an opening, through which the rosin flows into the wider part of the vessel. They then mount upwards; opening every bag of rosin as they ascend, emptying the small vessel from time to time, as occasion may require, into the flask at their side.

In this manner they proceed from day to day, emptying their flask every night into a larger vessel, which they take care to provide for that purpose; and when they have collected the whole that they intend to gather that season, they  
 filtre



filtrate it through a strong cloth, to free it from leaves and other impurities, and then put it into proper vessels for the market. If this is put into a cucurbit with a little water, and distilled, the essential oil rises free from the grosser substances with which it was united, and forms the genuine oil of turpentine. What remains in the cucurbit is a dryish resin, something like *colophony*.

The *spruce-fir* likewise affords a resin in considerable quantities, although differing greatly in quality from that obtained from the *silver-fir*, and is procured by a very different operation; for whereas the true turpentine from the fir is always in a sort of semi-fluid state, that obtained from the *spruce* \* is always solid in the ordinary heat of our atmosphere; nor is this last

\* Let not the reader forget that I am not speaking of the *spruce* strictly so called, but that species of *fir* vulgarly called *spruce-fir*, *pine-fir*, &c. distinguished by the name of *epicea* by the French.

contained

contained in small bags in the bark, like that above mentioned, nor in the body of the wood like the *larix*, but is found only to flow out from between the bark and the wood.

The peasants, therefore, in order to obtain it, cut out a part of the bark at the beginning of the season (the month of April or May) without hurting the wood; and leaving it in that condition at that time, return at the end of a few weeks, and find the whole wound covered over with a crust of solid rosin, which had there concremented as soon as it flowed out and was exposed to the air; this they scrape off into a basket, and having pared away a little more of the bark round the edges of the wound, to keep it fresh, leave it in this state for as long a time.

In this manner they proceed during the whole season; at the end of which they put the whole into large caldrons, with

with a little water, and melting it slowly, by means of a gentle fire, pour it into strong bags of cloth, and while it is yet warm and fluid, put it under the press, which squeezes out the rosin, and separates it from all impurities; after which it is barrell'd up for sale. The substance which is obtained by this operation is of a yellowish colour and solid consistence, turning soft in a gentle degree of heat, and is well known in Britain by the name of *Burgundy pitch*. An oil is also extracted from this, which is sold by the name of *oil of turpentine*, but much inferior in quality to that obtained from the *silver-fir*.

The roots, if bare, afford a rosin of the same quality, and in the same manner as the trunk: and it is observed, that such trees as are planted in a rich soil afford more rosin than those that are planted upon a poorer; and more is got in a warm dry season, than in one that is cold and wet.

The

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The trees of this class yield some rosin when very young, and always continue to do so till they begin to decay by age; but it is remarked, that what is gathered from young trees is softer than what is obtained from those of a greater age, altho' it is never entirely fluid. A healthy tree in a good soil will yield thirty or forty pounds of rosin each year \*; so that the

\* It is upon the credit of Mr Du-Hamel that I mention this produce. If this is so, the profit from an acre of ground behaved to be very considerable. I am not much acquainted with the value of this substance, but have been told it usually sells for about sixpence *per* pound. But let us suppose it to be worth only twopence, and each tree, at a medium, to yield only twenty pounds in a season, worth 2s. 4d.; as a Scots acre would contain about 450 trees, if planted at twelve feet from each other, the value of the rosin, at the above rate, would amount to 75l. sterling *per annum*; nor could the expence attending this be very considerable, one man being sufficient to take care of upwards of a thousand trees. I am far from thinking that the profits could be so great as this; but as Mr Du-Hamel is a man of character, it is obvious the profits must be very considerable. I meet with no estimate of the quantity of rosin afforded by the *silver-fr.*

profit



profit arising from this must be very considerable.

The *silver-fir* is not in the least damaged by having its rosin taken from it; but as the rain and snow enter the body of the *spruce* at the large wounds made in the bark, it in time impairs the wood a little, though slowly; and if the tree is not so far damaged as to make the wood turn red, it is as good for every purpose as before the rosin was extracted from it. Thus it appears, that a plantation of these two kinds of trees might be made to turn out to good account, even in situations where the wood could be of little value; and it is more than probable, that either of these kinds of trees would afford *tar* as well as the *pine*, although I do not know that ever it has been tried. They likewise afford an excellent charcoal. In my next, I shall shew the various uses that may be made of the *pine*.

AGRICOLA.

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LETTER

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LETTER SEVENTH.

*Of the Pine-tree—Method of extracting its  
Rosin—Manner of making Tar, &c.*

S I R,

July 18. 1771.

HAVING pointed out the uses to which the *fir-tree* might be applied, it would be improper not to mention the substances that may be drawn from the *pine*, which are not perhaps of less value than those extracted from the *fir*.

The *pine*, as well as the *fir-tree*, affords a resinous juice, although of a different nature in itself, and must be gathered after a different manner. This juice is neither collected in reservoirs in the body of the tree, like the *larix*; nor in cavities in  
the

the bark, like the *fir*; nor does it ooze out only between the bark and the wood, as in the *spruce*; but it is dispersed through the whole body of the wood, and flows forth from any fresh wound that may be made in the body of the tree in a semi-fluid state, which it in some measure loses when exposed to the air, becoming gradually of a thicker and more solid consistence. This being the case, the most proper method of collecting the rosin is as follows;

About the month of May, when the sap begins to flow in abundance, those who make it their business to gather this rosin, make choice of a proper tree, and having first taken off a piece of the outer bark about a foot square near the root, they then cut off, with a very sharp instrument, about four inches square of the inner bark, piercing through it a little way, so as to take off with it a thin paring of the

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wood.

wood. As soon as it is made, the resinous juice immediately begins to ooze out through the pores of the wound, and drops down, in the consistence of a thickish balsam, from the under part of it, into proper vessels placed below to receive it; but as the edges of the wound shrivel up, and the pores are quickly contracted when exposed to the air, so as to prevent it from flowing out with ease, it is necessary to refresh these wounds once every ten or twelve days, by cutting a thin slip of the wood and bark from the two sides and top of the wound, and likewise a very thin paring of wood from the whole inner surface thereof, which allows the juice to flow afresh as well as at the beginning. By repeating this operation from time to time, during the summer months, the hole becomes larger and deeper; so that, by the end of the season, it is usually about an inch or two deep,  
and



and twelve inches square, so as to occupy the whole of the space that was at first stripped of its outer bark. The next year after this, they make a fresh wound of the same size immediately above the old one, (for it is observed that the juice always descends), and manage it in the same way as the former one; and so on they proceed, making a new wound each year immediately above the old one, till they are as high as they find convenient; after which they begin again near the root in another part of the tree, and carry up another row of openings of the same kind; proceeding in this manner round the whole circumference of the tree, if it continues so long in health, or affords a quantity of rosin worth the expence.

I need hardly observe, that they empty the vessels which are placed at the trees from time to time, and carry it home, to be

be kept all together till they have gathered all that they can get for that season. After the whole quantity is collected, they filtre and barrel it up for sale in the form of a very thick resinous balsam, which is used by ship-builders for different purposes; and in this state it is known in France by the names of *Galipot* and *Perrinne*; but I am unacquainted with the name by which it is known in England. In some cases, it is boiled in large caldrons, till it is so far inspissated as to be of a solid consistence when cold, and is, in that state, put into barrels, and employed by the ship-builders for different purposes: and sometimes it is mixed with a little water, and strongly stirred and mixed together, which changes it from a dark to a whitish colour, somewhat resembling wax, which forms the substance commonly sold in the shops by the name of *Rosin*. There may likewise be extracted  
from

from it an essential oil by distillation; but it is so much inferior in quality to that obtained from the fir or *larix*, as to be but little regarded. It is known in France by the name of *Eau de rasé*.

These are all the substances which have been hitherto extracted from the *pine* by incision, in such quantities as to form any sort of manufacture. But it is not to be expected, that, among the great diversity of trees belonging to this class, there should be no diversity in the nature of the juices that they afford, or the quantity they produce; but as I have not been able to get distinct information concerning this head, I must content myself with informing the reader, that it seems to be agreed, that the large pine, with eatable fruit, is improper for these purposes: and I much doubt if the *Scots fir* would answer well. The kinds which are chiefly employed in France and Spain, for these purposes,

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purposes, are the *Pinus maritima major*, DOD. *vel pinus maritima prima*, MATH. and the *pinus maritima minor*, C. B. P. It is very probable, that some of the American pines, as yet but little known, might afford other kinds of rosin, or balsam, perhaps in greater quantity, or of a finer quality than that above described; particularly Lord Weymouth's pine, which discovers some vessels like veins in the bark, filled with a fine resinous juice, the uses of which have not as yet been discovered.

Although the pine-tree will yield some resinous juice when very young; yet they seldom begin to extract it from them till they are eighteen or twenty years of age; for they are observed to perish very soon if they are opened before that period. Such trees as grow upon rich ground yield more juice than those that grow upon a dry barren soil, although the wood

is



is of an inferior quality. A healthy pine, of a proper age, will yield twelve or fifteen pounds of rosin each year \*, and, if properly managed, may continue to do so for fifteen or twenty years : nor is it found that the wood of the tree is rendered worse for having the rosin extracted from it, so that it may be then cut down, and employed for the same purposes as if it had remained untouched.

It is from the pine only that *tar* is extracted ; and the same kind of tree which affords the rosin, by a different process, affords this viscid, oily, empyreumatic substance, of such extensive use in many arts and manufactures ; but although the same trees afford both these substances, yet it is found by experience, that such as have grown upon a dry, warm soil,

\* Suppose twelve pounds each tree, at 1 d. *per* pound, this, for 450 trees, amounts to 22 l. 10 s. *per* acre *per annum*.

and have a firm reddish wood, afford the greatest proportion of tar; whereas those which grow upon a rich soil, and have a soft spongy wood, yield the greatest quantity of rosin: therefore a dry barren soil will be most proper in general for the manufacture of *tar*; whereas one of a richer nature will afford a greater quantity of rosin: but these two manufactures ought ever to go hand in hand, and on no account be separated from one another, for many obvious reasons.

Either of these kinds of wood afford a good charcoal; and as it must be *burnt* before either the tar or charcoal can be produced, they are often both obtained by the same operation; but, according as the one or the other is the principal object attended to, the operation must be a little varied.

If the situation is such as to make the tar the principal object of concern,  
then

then it is proper to split the tree, cutting away the outer white wood, and only taking the parts which are red, and full of a fatty resinous juice, particularly the knots and excrescences where branches have been cut off; and if the manufacture of rosin is carried on at the same place, the then laminæ, cut off to refresh the wounds, ought to be carefully preserved, as they afford a great proportion of tar. These picked pieces, when properly consumed, yield a very large proportion of tar of the very best quality, usually about one-fourth of the weight of the whole wood put into the furnace; but if the charcoal becomes an object of consideration, then all the parts of the trunk are employed indiscriminately, as well as the branches; and even the roots are employed for this purpose, as they are found to yield it in considerable quantities, especially those of the trees that have previously af-

forded rosin; as the workmen in *Provence* always imagine that these yield a larger proportion than those of other trees.

In all cases, it is essentially necessary for this operation to have the wood about half dried; therefore the workmen continue to fell the trees the whole year round, in proportion as they need them; and when they are of a proper degree of dryness, they are brought to the places where they are to be burnt; there they are cut into lengths proportioned to the size of the kiln; and the trunk and large branches are divided into small billets of an inch or two square.

The kilns in which they are burnt are of different forms and sizes in different places; but the most usual form is that of an egg placed upon its great end, and the size from five to ten feet in height, with other dimensions in proportion to the height. The under part of the kiln  
is



is always made of hewen stone, and the very base usually consists of one stone hollowed out in the inside, so as to resemble the shape of the under part of an egg. About six inches above the lowest part of it, on one side is made a hole slanting downwards a little, into which is fitted a piece of an old gun-barrel, or other hollow cylinder of iron; and a little above that is placed an iron-grate. The hewed stones usually reach about one third of the whole height; and above that it is formed of brick or stones, cemented with well-wrought clay, and closely and compactly built.

When the whole is ready, and the wood cut, it is put into the kiln, laying one stratum of the billets across the grate, and another across these, and so on to the top; taking care to arrange them as well as possible, so as that no vacancies may be left. When it is filled to the top, a few  
 billets

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billets of dry wood are put upon it; and over the whole is placed some flat stones made on purpose, which join close together, and support one another, leaving only a small opening at the top, of five or six inches diameter: it is then lighted at the top; and when the dry wood is sufficiently kindled, a flat stone is applied to the opening, so as to damp the fire, and make it burn slowly: for upon this article, in a great measure, depends the success of the operation. The workmen by habit acquire in time a great degree of accuracy in this respect; and when they see it burning too quick, they cover the joinings of the stones with wet earth, which they take care to have ready at hand for that purpose, and in this manner regulate the fire till the whole of the tar is extracted; after which they cover the whole quite close up till the fire is extinguished; and when it is

is cold they take out the charcoal, and begin the same operation anew.

During the course of the foregoing process, the tar (which is composed of the rosin and sap of the tree, melted by the heat and mixed together) is forced to drop down from the pieces of wood below the fire, and falls to the bottom; and after having risen as high as the hole in the bottom of the kiln, it then flows out of the tube into vessels placed without the kiln to receive it; from whence it is taken, and put into barrels for sale. When they open the furnace, they take care to collect all the soot which is found sticking to the flat stones on the top, as well as on the inside of the kiln, and put it into small barrels for sale; this being the well-known substance called *lamp-black*.

From a slight review of this article, it will appear obvious, that few trees afford a greater variety of useful products than  
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the *pine*; for, besides the value of the wood, which is considerable where there is consunt for it, the same tree may be successively made to yield *rosin*, *tar*, and *pitch*, *lamp-black* and *charcoal*.

I have never heard that tar has been extracted either from the *fir* or *larix*, although, as I have already observed, from the resinous nature of these trees, it seems probable that both of them might be made to afford it in as great quantities as the *pine*: nor have I been able to learn, whether any of the different kinds of pines are incapable of being made to yield this substance in abundance; and in particular, whether the *Scots fir* would be proper for this use or not.

AGRICOLA,

LETTER



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LETTER EIGHTH.

*The Method of making Pot-ash.*

S I R,

July 25. 1771.

I N my former letters, I hope I demonstrated pretty clearly, that there are few situations so unfavourable, in which some advantage might not be made of a plantation of some of the *coniferous* trees; but as these plantations in a short time decay, and need renewing, I should think that I left the subject unfinished, if I did not point out several other products which might be drawn from other kinds of trees, of which considerable profit might be made even in the most remote situation.

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Where wood can neither be sold in substance, nor any advantage be made of it when reduced to charcoal, we have it still in our power to extract from it that useful alkaline salt, known by the name of *potash*; which is of such a value as easily to bear the expence of carriage from the most remote and inaccessible part of our island, to the places where it may be sold, and for which there is such a constant encreasing demand, as prevents us from having the smallest fear of ever being able to overstock the market; but, on the contrary, as this is an article so essentially necessary for carrying on the staple manufacture of this part of the kingdom, there is greater reason to dread the want of a sufficient quantity to answer all our purposes: For should any misunderstanding ever arise between us and those kingdoms from whence we are at present supplied with this article, it is difficult to point out all the

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the bad effects that might accrue to the nation on that account. Or even supposing that this should not be the case, yet it is not to be expected, but that those who furnish us with it, will, sooner or later, perceive, that it is an article that we *must* have, and consequently they will raise the price of it as high as they please, (as it is well known the Dutch practise every day with regard to flax), which would produce a mischief of such a serious nature, as ought ever to be guarded against with the utmost care, and therefore deserves the attention of every well-wisher to his country. Now, as it is certain, that Scotland might easily produce as much pot-ash as would not only be sufficient to answer all the purposes necessary for carrying on its own manufactures, but also supply all England and Ireland with this commodity, if one hundredth part of the ground proper for this purpose were ap-

propriated to that use, I must again recommend this subject to the attention of those gentlemen whose estates lie in the inland and mountainous parts of the country, which are on that account incapable of any other improvement; and beg of them to make such plantations as their soil, situation, and conveniency, may point out as proper; in the full confidence that this will more effectually improve their estates, and better their fortunes, than any other plan which they could possibly adopt.

It is found by experience, that almost every tree, when *properly* reduced to ashes, will afford a certain proportion of this alkaline salt; but some yield it in much larger proportions than others. The resinous trees are, of all others, the most improper; which is the less to be regretted, as we have already seen that they can be of use in another way. Al-  
most



most all the other trees, commonly known by the name of *barren timber*, yield it in considerable proportions; but the *beech* is esteemed the best of all for this purpose; and next to that the *hornbeam*. I cannot pretend to point out exactly the order in which the other trees do follow these in this respect, not having any books at hand which could direct me in the search: but such of your readers as have an inclination to be better informed concerning this article, may, if they chuse it, have recourse to a curious memoir on this subject, written by Mr *Geofrey*, and published in the Memoirs of the Royal Academy of Sciences at Paris, some time between the year 1715 and 1720, or about that period. I, for my own part, am but little anxious about the result of this inquiry, being fully persuaded, that no tree which can be named could be preferred to the *beech*; as few, if any, trees thrive so well  
as

as this on dry mountainous ground, in an exposed situation ; grow so quickly, or arrive at such a magnitude : On all which accounts, it is the most proper tree that could be devised for this purpose. And, from my own experience, I can aver, that it thrives remarkably well when planted among any trees of the coniferous tribe ; among which it ought always to be planted, if it is intended for this use ; because, while *it* is advancing in magnitude, the *fir* would yield its resin ; and when they arrived at a considerable size, so as to be crowding one another too much, it would be time to cut out the resinous trees for making tar, which would give the beeches room to grow ; and by the time that the whole of the resinous trees were felled, they would be arrived at a great stature, and fit for making *pot-ash*.

But although I recommend the beech-tree so much for this particular purpose,

let

let the young planter observe, that this is the only case in which this tree can be planted, so as to become more valuable than any other; because, on account of its brittle quality, the wood of the beech-tree is not of such value for almost any mechanical purpose as some other trees; the ash and elm being tougher where strength and elasticity are required, and the oak and hornbeam harder, as well as tougher, than it is.

The only art necessary in making *port-ash* is, to consume the wood with as little flame as possible, until it is reduced to ashes. For this purpose, it is necessary to have a kind of kiln, somewhat resembling that which is employed in making tar, already described; only it must have air admitted during the operation, and therefore it must not only be more open at top, but also must have an opening below, with a door to shut or open at pleasure, as circumstances

cumstances may require. For if too little air is admitted, the wood would only be reduced to a charcoal, and not to ashes; and if too much is admitted, so as to make it flame vigorously, it is found that the alkaline salt is in a great measure dissipated during the operation, so that the ashes thus obtained yield little or nothing. The whole nicety of the operation, therefore, depends on admitting just enough of air to consume the wood slowly, and reduce it to ashes, and no more.

After the fire is extinguished, the ashes are collected, and put into tall cylindrical vessels, and tramped quite close. These vessels are then placed above one another; the bottom of each being pierced full of small holes, or made of basket-work, to allow it to filtre freely. Water is then poured gently upon the uppermost, which sinks gradually among the ashes, and in its course dissolves and carries along with it the alkaline



line salt with which the ashes were impregnated; and having passed through the uppermost vessel, it falls into the second, and carries off a greater portion of alkali; and so on to a third, or fourth, or more, till, upon trial, they find that their *lie*, as it is now called, is of a sufficient degree of strength. Fresh water is still poured upon the ashes, till it comes from the first vessel pure and tasteless, which is then removed, and the second becomes the uppermost; another fresh vessel being placed below instead of the one that is removed; and when the second transmits the water pure, it is removed in its turn, as is the third and fourth; and so on *ad infinitum*.

The *lie* being thus obtained of a sufficient strength, may be employed without any further operation, if a manufacture of soap, or any other in which this salt is employed, be carried on in the neighbourhood; but if it is to be transported to a

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distant

distant market, it is necessary to reduce the salt to a solid state, by evaporating the water from it. Many contrivances have been fallen upon to facilitate this operation, which it would be superfluous for me here to enumerate, as it is universally allowed, that the best method is to boil it slowly over the fire in the ordinary way, till the moisture is all exhaled; and when the salt is dry, barrel it close up immediately, before it can have time to imbibe the moisture from the air, which it always does with great avidity.—Such is the operation for obtaining this useful substance; by means of which, wood, in the most inaccessible corner of the country, may be made to turn out to great account. If this account shall induce any, whose interest it may be, to turn their attention to this subject, it will give a sensible pleasure to

AGRICOLA.

LETTER

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LETTER NINTH.

*Of the Sugar-maple—Method of extracting  
its Juice; and of other Saccharine Juices  
of Trees.*

S I R,                      August 1. 1771.

**F**EW subjects afford a more ample field  
for contemplation, or a more inno-  
cent recreation for the mind, than the  
study of the nature and properties of the  
vegetable kingdom. Chance has discover-  
ed some of the properties of these, and  
the invention of man hath been able to  
turn some of those discoveries to the most  
valuable purposes in life; yet when we  
examine this subject with attention, it

does not seem to be exhausted, as we find many objects relating to it, which bid fair for being extremely useful to mankind, that have never yet been examined at all. If we look around us in the world, and compare different countries with one another, and with ourselves in this respect, we will soon discover, that, on many occasions, one nation, or even a part of a nation, employs, for the most valuable purposes in life, certain trees or plants which are neglected and despised by others, although the subjects which afford them are daily before their eyes and in their hands. How many countries in Europe are destitute of many of the vegetable products I have mentioned in this series of letters, and are obliged to import them, at a considerable expence, from others, while the very trees that afford them are rotting at their doors, and little or no use is made of them? After this, need we be surprised



surprised to find, that some countries should produce vegetables which may be possessed of inestimable properties, of which the inhabitants, or even the whole world, may as yet be entirely ignorant? How long was mankind acquainted with the sugar-cane before they knew all the valuable substances that might be extracted from it? and how many nations at this day produce the most excellent grapes, of which the inhabitants know no other use but to employ them as a refreshing fruit? Even the Chinese themselves, who boast so much of their inventions, and excel in several *other* arts, although as fond of the fermented juice when it is given them as any of their neighbours, and although they have the fruits which afford it growing to perfection in every corner of their country, are to this hour ignorant of the manner of making wine for themselves, although the missionaries have made it  
among

among them for near two hundred years.

Seeing then that this is the case, even with regard to things whose qualities have been already discovered, and that mankind are so slow in adopting lessons which are given them by others, can we be surprised if they have totally overlooked many qualities which trees and other plants may as yet be possessed of, about the nature of which we may now be totally ignorant, although time may perhaps, on some future occasion, discover them to some diligent inquirers? It is therefore our duty, as reasonable beings, to pay some attention to the objects which are daily under our hands, and endeavour to discover the properties of which they may be possessed, by trying such experiments as we easily can upon these subjects which have not hitherto been sufficiently examined; but especially upon those, which, from any sort of analogy  
with

with others whose properties may be already known, give us the fairest prospect of succeeding.

I might point out many subjects in the vegetable kingdom, which would merit our particular attention; but as I have all along confined myself to the produce of *barren timber* alone, I shall not here consider any other vegetable whatever. It is well known, that some trees yield a juice, when properly treated, which is of considerable value, and much esteemed by those who are acquainted with it; and as this is the case with some trees, whose external appearance denote nothing particular, this naturally might make us imagine, that it is possible the juices of some other trees might be of use in the same or some other respect; and as the experiment can be tried with so little trouble or expence, we would naturally have imagined, that a very few years after the discovery of this property

property of the juice of some trees, the qualities of the juice of every tree produced in this country, and the various uses to which it might have been applied in medicine or arts, would have been sufficient to have ascertained, with the utmost precision; and yet the reader must be conscious to himself, that unless it is the *sugar-maple* and the *birch-tree*, he has hardly heard of any other that ever has been examined with this view. And as it is possible he may not even have heard of these, or may not perhaps have heard distinctly of the manner in which they are extracted, or the uses to which they may be applied, I shall briefly explain a few of the particulars relating to it which have come to my knowledge.

There is found in North-America a certain species of maple, upon which the natives have bestowed the name of the *sugar-maple*, because from it they extract a juice which



which yields a perfect sugar when evaporated, which the inhabitants of Canada employ for every purpose that would require sugar, and for many uses prefer it even to that extracted from the sugarcane. The method of obtaining the juice, and preparing the sugar, is as follows.

The Canadians extract this juice from two kinds of maple, one of which greatly resembles our *plane* or *sycamore*, which is likewise known by the name of *plane* with them; the other has a smaller leaf, more resembling that of the lesser maple, and is called by them the *sugar-maple*. They distinguish the sugar made from these two trees, calling one the sugar of *maple*, and the other the sugar of *plane*. The juice is obtained from both of these trees by the same operation; which is by boring a hole in the under part of the tree, penetrating into the heart of it, and slanting a little upward, that the juice

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may

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may flow out of it with the greater ease; and at the mouth of the hole they fix a chip of bark, or small wooden funnel, to direct it into a vessel placed below to receive it.

As it is found by experience, that the tree affords no juice in the summer-season when in full sap, it being always observed to stop from flowing when the buds begin to swell, and the bark separate from the wood, they make their incisions during the winter-season, between *November* and *May*. But as the winters are exceedingly severe in that climate, and as they observe that the tree yields no juice but during the time of thaw, they generally obtain very little till the first of *March*; on which account many of them do not make the holes in the trees till that time: and as it always yields most juice when the weather is warmest, they usually make these holes upon the sunny-side of the tree.

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From the beginning of *March* till the middle of *May* is the principal season for collecting this juice; and during that time it often flows in such abundance as to run in a continued stream, which is sometimes as large as would fill a writing-quill, and will fill a *Paris* pint-jug in a quarter of an hour: from whence it may be in some measure guessed what quantity will be yielded by one tree in a season, and the sugar that may be extracted from it, as it is usually computed that twenty pints of juice will yield a pound of sugar \*.

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\* If, with a view to make a calculation of the profits that might be reaped from this article, we suppose, that instead of running one pint in a quarter of an hour, it should at a medium run only one pint in four hours, this would be six pints in twenty-four hours; and if we suppose that the season for collecting it should only be sixty, instead of seventy-five days, the whole quantity collected in a season from one tree would be 360 pints, which, at the ordinary proportion, would yield eighteen pounds of sugar, which, at 6d. *per* pound, amounts to 9 s. sterling.

The juice, as it flows from the tree, is clear and limpid as the purest water, cool and refreshing to the taste, leaving upon the palate an agreeable sweetish taste, that from the maple being *sweeter* than the *plane*, but the juice of the plane more *agreeable* than that from the *maple*. If the juice is drank as it comes from the tree, it is extremely wholesome, never occasioning the smallest inconvenience, not even when drank by a person extremely warm,

Now, as an acre of ground will contain 540 trees, if planted at ten feet distance from each other, if we were to suppose that each of these should yield the same, the value of an acre would be 243 l. sterling *per annum*; but if it should be thought that these trees would be too close upon one another, on that account we shall suppose them planted at the distance of twenty feet; still the value in this case would amount to upwards of 60 l. sterling *per annum*; which is a profit so immense as can scarce be believed possible; yet as the above facts are related by Mr *Du-Hamel*, (see his *Traite des Arbres et Arbustes*, article *ACER*), it must be supposed that they are founded upon facts, and clearly prove that the profit might become very considerable.

and



and covered over with sweat. Towards the end of the season, however, when the sap begins to ascend, this sugary juice acquires a kind of herbaceous taste, which renders it far less agreeable; nor is it so easily evaporated to dryness as before, and therefore ought to be set apart for inferior uses.

After a sufficient quantity of this juice is obtained, it is put into large caldrons, and boiled upon the fire, to evaporate the moisture; the person who has the charge of it being very careful to stir it during the whole time; but more especially towards the end of the operation, to prevent it from acquiring a burnt taste, which it most certainly would do if this operation was omitted: they likewise take care to skim off from time to time any impurities which may arise on the surface. When it hath acquired the consistence of a thick syrup, it is taken from the fire, and put  
into

into moulds, in which it gradually hardens as it cools, and becomes at length a reddish brown sugar, extremely agreeable to the taste, if it has not been too long kept upon the fire during the operation; but if that has been the case, it acquires a taste somewhat resembling that of melasses, which is far from being agreeable.

As I once obtained a small quantity of this sugar, by the favour of a friend who came from Canada, I doubt not but your readers will be better pleased with a description of that as it appeared to me, than any other that I might copy from other writers. It was in the form of a pretty large thin cake, of a reddish brown colour, and semi-transparent; in this particular nearly resembling brown sugar-candy; only it was of an uniform texture throughout, and much softer, and more unctuous to the touch than any kind of sugar with which I am acquainted: it is likewise  
extremely

extremely apt to attract moisture from the air, so as readily to *deliquesce*, or run into a syrup, if not kept in a very dry place; but the syrup is not so adhesive or *gluey* as that of common brown sugar; and the lumps are easily broken, like sugar-tablets. With respect to taste, it seems to have far less of that acid quality which affects the throat with a sort of fiery roughness, than any other kind of sugar; being more mild and bland, and having a most agreeable balsamic sweetness. It is greatly recommended in all the places where it is known, as of great use in colds, being extremely mild and softening for the breast. I employed it for that purpose with myself and some others, and all of us thought that it well deserved the character it had obtained; but whether our imagination might not, on account of its novelty, help to make us attribute to it greater effects than it really deserved,

deserved, I will not pretend to say: at any rate, I think it is fully *as* agreeable as any other kind of sugar; and if it were refined, it would probably be more so, the inhabitants in that country being content with it in its first state, without seeking to refine it, excepting that in some cases they clarify the syrup with whites of eggs, which renders it more beautiful and pleasant.

A tree will continue to yield juice for a very long time, without being in any measure hurt by it, if only one hole is made at a time; but if too great a number are opened at once, it hurts the tree a good deal, and sometimes makes it even perish entirely. It is always necessary to make a fresh hole each year, as there is never any juice flows from it but that year when it is made. Young trees afford a greater *quantity* of juice, but that obtained from



from old trees is of a richer *quality*, and yields a greater proportion of sugar.

Such is the method of obtaining, and such the quality of the juice of the maple. With regard to the birch, it yields its juice in the same manner as the other; but I never have heard that sugar has been hitherto extracted from it. Whether this is because it is incapable of being made to yield this, or because it never hath been fairly tried, I cannot say, as I myself have never had an opportunity of examining this so particularly as the importance of the subject would seem to deserve. But however that may be, it is certain that it has been hitherto only employed as a pleasant cooling drink, which almost every one who has ever tasted it is exceedingly fond of, describing the taste of it nearly in the same terms as the Canadians describe that of the maple-juice, saying, that it has a pleasing sweetness,

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with

with a refreshing coolness, so as to be as agreeable as can well be imagined.

I have not heard that either the *birch-wine*, (as it is commonly called), or the maple-juice, has ever been fermented, although there is the highest probability that either of these would afford a vinous liquor of a very refreshing kind, if they were subjected to this operation; nor can there be any doubt, but that they would be susceptible of fermentation by a proper management, as it is now sufficiently well known, that every *saccharine* juice is naturally disposed to run into the vinous fermentation, if put into proper circumstances. I would therefore recommend it to those who may have a proper opportunity of doing it, to try this, seeing it is so highly probable that they may thus obtain a wine of a very pleasant kind, at a very moderate expence. The probability indeed is, that this juice would be so much

much diluted as to be incapable of affording a wine of a strong body ; but this defect might be in some measure remedied, either by boiling the juice for some time before it was fermented, or by adding a little sugar to it to render it richer, which seems to be the most eligible method ; as it is always found, that much boiling checks fermentation extremely on all occasions. Where a more ordinary sort of drink were wanted, it might be made by the help of a little melasses, or even malt, in very small proportions, might be employed for the same purpose.

It is a pity that we are as yet so little acquainted with the sugar-maple of America ; and it were to be wished, that those persons who are employed to collect American seeds for such gentlemen as subscribe for that purpose, were ordered to send over a much larger quantity of the seeds of this and other useful trees, than they

usually do, which would be of greater utility to the nation than that indiscriminate method that seems to be observed at present by those gentlemen, who seem to send as large quantities of the seeds of useless, as of valuable plants and trees. If this were done, we might, at a very moderate expence, get over such large quantities of these seeds as would render the trees much more common here than they are at present: and as it is not to be doubted but they would thrive, we might in a short time encrease them to such a degree as to reap considerable advantages from them.

In the mean time, let us try if any other tree can be found which will yield a juice that might be employed for similar purposes; and as it is found that trees of the same class are very often possessed of similar qualities, let us begin our experiments with the common maple, usually called

*plane-*



*plane-tree*, and the *alder* or *aller*, as it is commonly called. The first of these is so nearly allied to the maple, as to render it extremely probable that it will yield a juice in some respects resembling it; and the second being of the same family with the *birch*, may very probably be possessed of virtues somewhat similar to it \*. Next  
to

\* I never have heard that any experiment has ever been made upon the juice of the *alder*; but I find, by consulting some old writers, that the juice of the *plane-tree* has been sometimes tried with this view, and found to be fully as good as that of the *birch-tree*. As I had an opportunity last spring, I caused one or two small *plane-trees* to be bored, and obtained from them a considerable quantity of the juice, which had a pleasant sweetish taste as it came from the tree. I evaporated a little of this, which soon became as sweet as a thin syrup of sugar, and was very pleasant. I intended to have tried to bring it to a solid sugar, to have fermented it alone, and with sugar, melasses and barley, all separate from each other; but being unluckily engaged very much in other affairs, and called from home, these experiments were neglected; but from the little that I tried, I had very good reason to hope for a favourable conclusion from them.

to these the *oak* claims our attention; for every one knows that the leaves of this tree, in the end of May or beginning of June, are very frequently covered over in the morning with a thick clammy substance, remarkably sweet to the taste. Whether the juice would be of the same nature or not, experience alone should determine. The *beech* and *elm* seem likewise to be impregnated with a mild and

A considerable quantity of the juice was put by in bottles, which were left unstopped; and upon examining the liquor now, (June 26.), I find, that instead of being vapid or musty, as I expected, it has now acquired a pleasant acid taste; which plainly shows that it must have undergone the vinous fermentation, although it could not be expected, that in these unfavourable circumstances it could have remained long in the vinous, but must have quickly hurried forward to the acetous state. I intend to repeat my experiments next year; and if any of my readers should, from these hints, be induced to try the same, I must caution them against using earthen vessels of any sort for collecting the juice at the tree; for as these must be left abroad all night, they run a great risk of being broke if it should come a frost before morning, as I have experienced to my cost.

bland

bland juice \*, and therefore deserve our attention. In short, as it is impossible *a priori* to determine what may be the case with regard to any tree, it is proper that they should *all* be particularly examined; and after this is done in a fair and satisfactory manner, we will at least be certain that we do not lose through negligence any thing that could be of use to us: and it is highly probable, that by a

\* I am sensible that some of the trees above mentioned do not bleed in the spring when wounded, like the *birch* and *maple*; and therefore their juices, if obtained at all, would require to be collected in a manner different from that which is practised with regard to these. What that particular method may be, or whether any method already has been, or ever will be, discovered for doing this, I cannot say; but we have already seen, that every one of the coniferous trees affords some kind of resinous juice, although this must be extracted from each particular kind of tree by a different process; and it is not impossible but that there may be other methods of obtaining the juices from some particular kinds of deciduous trees, different from that which has been hitherto practised.

careful

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careful examination of this subject, we might make some discoveries which would be of real consequence to ourselves and the community, of which we are a part; which, if it could be accomplished, would afford a sensible pleasure to

AGRICOLA.

“ I find that the Canadians likewise obtain a sugar from a particular kind of *Walnut-tree*. This ought to be an additional incitement to our industry.

LETTER



LETTER TENTH.

*Of the Bark of the Oak, and other Trees  
which can be of Use in Arts, &c.*

S I R,

August 22. 1771.

**N**OT only the wood, the ashes, and the native juices, but even the *bark* of trees, is, on many accounts, of singular use to mankind, and may, on many occasions, yield a very considerable revenue to the planter. Not to mention the different kinds of bark, which are of use in medicine or *dying*, I shall here chiefly confine myself to take notice of those kinds which are employed for *tanning* leather, as this is the only manufacture which

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could consume so much as to become of consequence to the improver.

The only tree, whose bark is universally employed for this purpose, is the *oak*; but there are many others which are used for the same purpose in different parts of the globe; and probably there are many more that might be of great utility in this way, which have not hitherto been examined. I have already observed, that the bark of the young *larix* is said to be employed for this purpose in those parts of the *Alps* where this kind of tree is most commonly cultivated: It is likewise asserted, that the same use is made of the bark of the *pine-tree*; and, in several parts of *Germany* and *America*, it is likewise said, that the *spruce-fir* is employed for the same purposes. The same may be said of the *alder*, the *sumach*, and the *coriaria*, or *myrtle-leaved sumach*, which is esteemed preferable to the *oak*: but as I have never  
heard

heard of any of these having been tried in this island with that accuracy that would be necessary, I know not exactly how much credit is to be given to these reports. Be this, however, as it may, it is certain, that, in several parts of Britain, the bark of the *birch-tree* is as constantly used for tanning leather as that of the *oak*, and sells at nearly as high a price \*; while, at the same time that this is done in one corner of our small island, the use of the bark of this tree is so little known in other parts of it, that I should not be surprised if some of my readers should doubt the fact, and laugh at my credulity for believing it; however, if any of these should chance to be acquainted with the Earl of *Aboyne*, let them ask at him, whether he makes any profit from this article; who

\* The common price is 10 s. *per* boll, reckoning eighteen stone-weight, Amsterdam, a-boll.

will soon satisfy them of the truth of what I now advance.

It is really surprising that mankind should, in many cases, be so slow to open their eyes to their own interest. One would naturally have imagined that the high price of *oak-bark* in this country, and the very great difficulty of procuring it in many places, would have long ago induced some person of enterprize to have tried if any other substance could be found that would answer as a *succedaneum* to it; but unless it be some hints that we have lately seen in the news-papers, that Dr *M<sup>r</sup> Bride* in Ireland had made some capital discoveries on this head, I have never heard that any person has attended to it in the least. What these discoveries of his may be, the public are not as yet informed; but if it be really true that this ingenious gentleman has turned his attention to this subject, and seriously made any experiment  
upon



upon it, I have not the smallest doubt but that he must have discovered some things that would be new to us, and of consequence to the public, as there is undoubtedly a great variety of vegetables that are possessed of the same quality by which the *oak* becomes of use to the tanner; although, perhaps, these may possess it in very different degrees, some *more*, and others *less* powerfully than the *oak*.

To point out *all* the vegetables which may have a chance of being useful in this respect, would be, in some measure, foreign to my present purpose, as well as beyond my power to perform, seeing that I have never been in a situation that enabled me to prosecute any experiments on this subject; yet, in order to give some assistance to such as may have inclination and convenience to prosecute this study, I shall beg leave to inform them, that there is the highest reason to think,

think, that the bark of the greatest number of trees or shrubs that are known, might be of *some* use in this respect; — for, as the *oak-bark* is useful in tanning, only because of its *astringent* quality, which helps to contract the pores of the leather, and make it impervious to moisture, we may naturally conclude that every other vegetable that is possessed of an astringent quality, will be of use in this respect, in proportion to its degree of astringency; and, as this is a quality for which the *bark* of trees *in general* are peculiarly remarkable (as there are very few which do not possess it in a lesser or greater degree), we ought to try to discover the degree of astringency that the bark of every kind of common tree possesses, and compare it with that of the oak; which would shew at once the comparative value of each of these in this respect. Now, as it is by means of this same astringent quality that vegetables  
become

become fitted to strick a black colour with vitriol of iron, we are furnished with a ready mean of discovering the degree of this quality by the deepness of the colour, that an extract of any bark in water gives, when mixed with a solution of vitriol; and may safely conclude, that every substance which can be employed by the *dyer* to produce a black colour, would likewise be of very great utility to the *tanner*: And although the *gall-nut*, so necessary to the *dyer*, could never be produced in quantities sufficient to be of any use in tanning; yet as the oak-bark, so universally used by the *tanner*, does not seem to be sufficiently astringent for the purposes of the *dyer*, while *sumach* is every day employed by the latter, we ought to conclude, that this would be of greater power in tanning than the bark itself. The same might be said of the bark of many other trees, which are found to be useful in dying;

ing; such as the *alder*, the leaves and bark of the *walnut*, the *ash-tree*, the *pear-tree*, and many others, which evidently discover, by the slightest trials, a considerable degree of astringency, and therefore deserve to be particularly examined; and among these, several species of the tribe of *willows* bid fair to hold a distinguished place. What a pity is it then, that this useful inquiry should have been so much neglected? more especially when we consider, that the method required for ascertaining the degree of this quality is so simple, and for the purpose of the tanner, at the same time so exact: I say, *for the purpose of the tanner, exact*; because, however imperfect every chemical analysis, even the most simple, must be for discovering the medical properties of bodies; which, when applied to the human frame, that wonderful nice machine, composed of such an immense variety of tubes and fluids



fluids circulating through these, and possessed of that delicate sensibility peculiar to animal life, by which the vital powers are often disturbed from causes imperceptible even to the senses themselves; when these, I say, are applied to this exceeding delicate frame, their latent and imperceptible qualities very often disturb the animal œconomy so much, as to counterbalance the effects which we might have expected from their other more powerful and perceptible properties. But, however cautious the *physician* ought to be in trusting to his experiments, it seems probable that the *tanner* may proceed with greater boldness and confidence; for as all his operations are confined to the lifeless animal fibre, which is incapable of any degree of irritability, he may rationally conclude, that it can only be by the most strong and obvious properties that they can produce any effect at all; and that

the more latent and imperceptible qualities which they may be possessed of, may be in a great degree, if not entirely, disregarded by him, so that he may in a great measure rest satisfied, that such substances as discover the marks of astringency by the usual chemical tests applied for this purpose, will be useful to him in proportion to the degree of it which they discover.

With this view, then, let him take a small quantity of the dried bark of the oak, and an equal quantity of the dried bark of any other tree that he would wish to examine; infuse each of these for an equal length of time in an equal quantity of water taken from the same place; then take an equal quantity of each of these solutions, and put them into transparent glass-vessels of the same size and form, and dropping into each of these a drop or two of the solution of green vitriol, if they

they are possessed of any degree of astringency, it will be immediately changed into a bluish-coloured liquor, and the deepness of the tinge which each takes will in some degree point out the proportional astringency of each.

After he has thus discovered which of them promise best, he may then try them upon leather; and a very little attention will discover whether they will answer his purpose or not.

If any of my learned readers have access to Dr Priestly's Essays, he will there find many experiments made upon this subject with a medical view, which may be of much greater use to *him*, when considered in this light, than they can be of to the physician.

I might here mention several other kinds of bark which are employed for many valuable purposes, particularly that of the Canadian *birch-tree*, so useful for

constructing these light canoes so much employed by the Americans. I might here also take notice of the use which they make of the bark of the same tree in Siberia and other northern countries, for coverings to their houses, &c. ; but as I am but little acquainted with the manner in which these are employed, and think that there is little chance of their being much employed in either of these ways in Britain, I shall not tire the reader by insisting any further upon them here.

Perhaps some may think, that the same excuse will not be admitted with regard to the *cork-tree*, whose bark is of such extensive use, and for which such large sums of money are sent out of this country every year. But although it is probable that every tree which can survive the winter-cold in France, will do the same in Britain, and that every tree whose produce does not depend upon the maturity of its fruit,



fruit, may be cultivated with as great profit here as in France, and that therefore the probability is, that the cork-tree could be raised here to advantage; yet lest some should think that I approached too near the regions of romance should I recommend this subject to the attention of the sober part of my countrymen, in order to avoid giving offence, I shall not do it, notwithstanding the favourable opening that the tree in Chelsea garden affords me, which, in spite of the daily wounds that it receives, has been preserved alive for such a great number of years.

I have thus, Sir, in a cursory manner, pointed out some of the principal uses to which the several parts of which trees are composed may be applied, independent of the value of the wood, that every one who  
intends

intends to make a plantation may have it in his power to reap every benefit from his trees that the nature of his situation will admit of. The value of the wood of each of the different kinds of trees is in general well known to every one in his own particular situation, which must vary so much according to different circumstances, as to be in some places of very great value, and in others of almost none at all: but I presume it would be impossible to point out a situation where some *one* or *more* of the products above mentioned would not render a plantation of trees extremely valuable, and in the end would prove of very great benefit to the country *in general*, as well as of inestimable advantage to the proprietor *in particular*; and therefore I must once more recommend this subject to the serious consideration of every gentleman of property, who wishes well to his country or his family. Whether it is  
more

more honourable for a man to turn his attention to such rural scenes as these, which naturally tend to calm the mind, and inspire it with a peaceful tranquillity; to cherish the seeds of every virtue, and expand the heart with generous and disinterested sensations; to make the innocent pleasures of domestic enjoyments be relished as they ought to be by every sober mind, and to secure affluence and independence, and along with it that genuine spirit of liberty, its constant companion; whether, I say, it is more honourable to pursue this plan of life, or to enter into the bustle of court-intrigues, to spend a genteel fortune by dangling after the great, or becoming the despicable tools of faction, and subject to the nod of some merciless despot, or cringing at the feet of some powerful villain, who would have been spurned away with horror, as a reptile which deserved to be trodden under foot,

foot, had the generous sense of a noble independence still kept possession of the soul.—But I stop.—The humane mind would wish to draw a curtain over these scenes of iniquity, and hide them as much as possible from the eye of innocence. Such of you, my dear countrymen! who know least about these tumultuous scenes, I heartily congratulate; long may you continue to enjoy the calm delights which a happy obscurity, that screens you from the notice of all but those united to you by the tender ties of friendship and cordial amity, most naturally affords. And if these my desultory speculations can in any way contribute to add to your felicity, I shall think myself abundantly repaid; or if I could flatter myself with the hopes that I might perhaps contribute any thing towards restoring ease to any one who may be threatened with the fear of want, or preserving the independence of any family which



which might be in danger of having their minds enslaved,—that most abject state of slavery that can be imagined, it would ever inspire with the most constant glow of pleasure, the breast of

AGRICOLA.

P. S. Since writing the above, I examined the following trees, in the method above recommended, excepting that I used the bark undried, with a view to discover the degree of astringency of their bark: viz.

- |                                                                           |              |
|---------------------------------------------------------------------------|--------------|
| 1. Oak                                                                    | 7. Lime      |
| 2. Birch                                                                  | 8. Laburnum  |
| 3. Broom                                                                  | 9. Crab      |
| 4. Beech                                                                  | 10. Hornbeam |
| 5. Rawn-tree                                                              | 11. Ash      |
| 6. Service                                                                |              |
| 12. A green willow, with a leaf resembling that of the Huntingdon willow. |              |

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13. Com-

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13. Common hoop-willow, with long narrow leaves, whitish on the under-side.
14. Green willow, with sweet-smelling leaves, commonly called *Bay-willow*.
15. Wild branching willow, with a grey bark and round leaves, of a light greyish colour.
16. True basket-osier    19. Silver-fir.
17. Larix                      20. Spruce ditto
18. Scots fir

Their degree of astringency, upon trying them, was as under:

1. The *oak*, which struck a deeper tinge than any of them.
2. *Ash* and *hornbeam*.—These two were nearly equal, and not much inferior to the *oak*.
3. *Green willow*, No. 12. and *bay-leaved* ditto, No. 14.—These were a degree

gree weaker than the former, but very little.

4. *Hoop-willow*, No. 13.

5. *Grey ditto*, No. 15.

6. *Birch*.—The gradations between the oak and *birch* were almost equal through each of these steps.

7. *Rawn* or *mountain-ash*, and *crab* or *apple-tree*.—Very little inferior to the *birch*.

8. *Lime*.

9. *Beech*.—The tincture was now but very slight, but still sufficiently perceptible.

10. *Basket-osier*, No. 16. *Larix*, common *fir*, *spruce* ditto, *silver* ditto, and *broom*.—All of these discovered a small degree of astringency, although but very little.—The two first shewed rather more than the others.

The *laburnum* did not discover the smallest degree of astringency; but

The *service* shewed a considerable de-  
D d 2 gree

gree thereof; but as the infusion was very thick, and of a brown colour, I could not know exactly in what part to place it, as I could not compare it with the others; but I think it may be considered as equal with the *rawn-tree*.

From this experiment we may draw several useful corollaries.

1<sup>st</sup>, As the *birch* bark is found by experience to afford a valuable *tan*, we may conclude, that all those placed above it will afford a more valuable still.

2<sup>dly</sup>, As we see, by this experiment, that different species of *willows* discover very different degrees of astringency, some of them approaching very near to that of the *oak*, while others scarce discover any at all, it is not impossible but that some may be found among the great variety of this kind of trees, which may approach still nearer to the nature of the *oak* than any of those that I had an opportunity of examining; therefore such persons who  
have



have a greater variety of these, ought to examine each of them with attention. This kind of trees ought to be attended to more particularly than any other, not only because they discover a great degree of astringency, but also because the bark of these could be more easily procured in considerable quantities in any part of the country than that of any other tree whatever. I recommend it to the basket-makers to cause the bark which they peel from their wands be tried by the tanner, as it appears that the hoop-willow, most commonly employed for making large baskets, is possessed of a great degree of astringency, although the smallest basket-osier promises to be of little or no use at all to the tanner.—But,

3dly, I find, since writing the above letter, by a memoir among those of the French Academy for the year 1766, that Mr ——— found, that common broom could

could be employed with advantage for tanning leather, and recommends it to his countrymen for that purpose, after having made trial thereof. Now, if broom is possessed of so much astringency as to be useful to the tanner, we may conclude, that the bark of every one of the trees which I examined, except the laburnum, would be still of greater use, as they all discovered greater degrees of astringency, and might therefore be employed on particular occasions in great emergencies.

Upon the whole, this experiment may serve as a guide to the tanner, to enable him to select such trees for the subject of his experiments as promise best to repay his trouble. Perhaps, he may discover, that some of those which appear equal in this trial, may be more or less proper for his purpose from some properties which they may possess that I have not attended to. I shall only further add with regard

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to this experiment, that I found, in peeling the branches, that the *birch* yields the thinnest bark of any: the *oak* does not afford a great deal; the *beech* could never be employed, as it is next to impossible to get the bark separated from the tree: the *ash* affords a large proportion of bark, as do all the species of *willows*, which is also more easily separated from the wood than that of any other tree.

After these experiments were finished, having recollected, that, when a boy at school, I had frequently eat the young shoots of brambles and briars, which I had observed to have a very peculiarly astringent taste, I resolved to try these substances also; and having prepared a fresh parcel of oak-bark, I took an equal quantity of the bark of the *bramble*, and another equal quantity of that of the *sweet-briar*, and having infused each of these separately, and added to each an equal quantity of the

the solution of copperas, I found that both of these shewed a degree of astringency as great as the oak-bark.

But finding that it would be difficult, in large works, to get the bark peeled from the shrubs, on account of their prickles, I resolved to try if they would produce the same effect if the pith (for it does not deserve the name of wood in the young shoots) and bark were taken together, as the bark alone; and with this view I bruised some of the young shoots of each of these shrubs, and cut them small, and infused them separately, and upon trial could find no difference between these and the bark alone. But that I might be still more certain of this fact, I took some shoots of the *bramble* which had been stripped of their bark, and, upon trial, found that these discovered as great a degree of astringency as either of the others. From the whole of this experiment, then, we  
may



may conclude, that the bramble promises to be the best succedaneum for the bark of the oak, as it is equally good with the sweet-briar, and could be more easily reared; and as the whole of the plant is useful, not only the expence attending the preparation of this behaved to be much more inconsiderable than what the preparation of the oak-bark requires, but also the quantity produced upon an acre of ground would be annually so much greater than could possibly be got of the other, that it could be afforded at a much easier rate. How much cheaper this might be afforded, it is impossible to say, without having made the trial; but I am persuaded that it could not amount to one tenth of the price of oak-bark, as this plant will grow in any soil, and, if annually cut, would send out shoots of surprising vigour. The effects which such an improvement would produce upon this branch of our manu-

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factures need not be pointed out; but they promise to be so great as at least to claim the attention of all those who may be more immediately concerned in it: and as every tanner has it in his power to procure a sufficient quantity of this plant for giving it a fair trial, I shall think it a reflection upon the spirit of my countrymen if none of them attempt it. I myself am totally unacquainted with every thing that relates to the practice of this art, else I should have saved them the trouble of this.

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LETTER ELEVENTH.

*On the proper Method of pruning Deciduous  
Trees.*

S I R,

October 14. 1773.

HAVING the pen in my hand, I shall embrace this opportunity of fulfilling a promise I made long ago, of offering a few observations on what appears to me the most successful method of pruning such trees as are not coniferous, when they are intended to be let stand for timber: and, to save the trouble of repeating a great many particular precepts, I shall premise a few general observations on the growth and œconomy of that particular

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species of plants, by attending to which, any man of judgment and discretion will know how to vary his mode of management as circumstances may require, without being perplexed with cases and distinctions, that it might be difficult, on many occasions, to discriminate or remember.

The leaves of trees are by nature intended to attract the juices of plants from the earth, and to serve as organs of perspiration, by means of which the superfluous juices are thrown off into the air: and as these leaves are always found at the extremities of the branches, and as the juices, in flowing to these extremities, deposit in their passage that matter which is gradually formed into wood, and serves to augment the size of the tree, it necessarily follows, that as all the juices that flow towards every branch of the tree pass through the undermost part of the stem,



stem, below the origin of all the branches, that part of the stem will be faster encreased in size than any other part; for, as every branch carries off from the stem, at the place where it diverges from it, all the juices that are pumped up by the leaves upon it, that proportion of the juices can no longer serve to augment the size of the stem above the insertion of that particular branch. Hence therefore it follows, that the stem of the tree will be more or less taper, according to the number, size, and position of the branches.

Now, as it is in general a desirable thing to have a tree rather to have a stem of some considerable magnitude, than to consist entirely of limbs and branches, it will be prudent in general for the man who has planted trees of this kind, to look over them from time to time, and where he finds any branch that bears too great a proportion to the size of the stem, instantly

ly to lop it off; for it is not with these, as with coniferous trees, that, when the leading shoot is broke off, some one of the lateral branches naturally advances above the rest,—assumes a more erect position, and becomes of its own accord the leading stem. For, among this class of trees, should the above-mentioned accident happen, each of the branches would encrease in size in proportion to the bulk that it originally bore, till the tree arrived at perfection; every twig continuing to make new shoots, and encreasing in size, without necessarily pruning itself, as the coniferous trees do.

Few who have planted deciduous trees seem to have omitted to make this observation; and many have drawn a corollary from it that seems to be extremely natural, although it leads to an erroneous practice. It is this. Since, say they, every branch that springs from the stem draws  
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off a part of the nourishment from thence ; and as the stem is the principal and most valuable part of the tree, it follows, that if all the side-branches shall be cut off, the whole of the sap will be determined to the stem and top-shoot, which will of consequence advance much faster than it would otherwise do. This, I honestly own, was the manner in which I reasoned in the early part of my life, and practised accordingly ;—but unfortunately I did not find the effect to answer my expectations. The tree, for want of a sufficient number of leaves, did not pump up such a quantity of juices as it otherwise would have done, so that the top made no extraordinary progress ; and as the stem, by being thus deprived of the means of being augmented in size towards the root, continued too small in proportion to its height ; and as the whole of the leaves and new shoots were at the top, the wind had such a power over it

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as to bend and strain it so much, as greatly hindered the free ascent of the sap, and in a short time made the tree become stunted and covered with moss; and if it chanced to be a quick-growing tree, with flexible branches, like the common Scots elm, the top became too weighty for the slender stem to be able to support, and it fell down to the ground, so as to make the most distorted and extraordinary appearance that can well be imagined. There is a plantation of elms belonging to a gentleman in my neighbourhood, who has persisted in stripping all the branches from the stem, and leaving only a few at the top, which at this moment has more the appearance of a field covered with large mole-traps, than any thing else to which I can liken it.

Being, from these observations, entirely satisfied of the impropriety of that practice, I have since observed, that, to pre-  
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serve a tree in the highest possible degree of health and vigour, it is necessary to train it so as that the stem may have a degree of strength sufficient to bear, without being too much bent, the wind to which it may be exposed, and that of consequence it may be with safety more bared in a situation that is well sheltered, than in one that is much exposed:—that, provided the stem can be brought to a proper figure, the greater the quantity of leaves that the tree is allowed to carry, the more luxuriant and healthy it will be; and that, to effectuate these purposes, the easiest way is, from time to time, to prune away the largest branches that seem to threaten to take an over-proportion of nourishment—to thin the top when too thick, so as to let in the air among the branches, without giving the wind too much power over it—and to leave upon the stem small branches proportioned to the situation

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of the tree, and placed in such a manner as the particular shape of the stem may require; for these small branches and the leaves they carry, serve to augment the stem, and give to the whole tree a degree of vigour that it would not otherwise acquire. To thin, then, judiciously is the proper province of the pruner, and not to strip the stem bare to a certain height, above which nothing at all is done; than which, I will venture to say, nothing can be more injudicious, except in a deep vale very much sheltered from the wind, in which the trees are thinly planted; in which situation this practice is far less pernicious than in any other.

The reader will easily perceive, that, in free shooting flexible trees, like the elm, it will be necessary to thin the top more, and leave more branches upon the trunk, to bring it to a proper degree of strength,  
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than upon such as grow naturally thicker, as the ash.

It may not be improper here to observe, that the oak, although the natural wood of this country, and happily adapted to our soil and climate, has been of late much less cultivated than it deserves, owing to various causes, among which injudicious pruning may perhaps be reckoned one. This tree is, in a peculiar manner, the *king of the forest*, and is with difficulty reared to perfection in any other situation. When young, it advances with great vigour, making every year two shoots, one in the month of *June*, and the other commencing in *August*, which usually continues to grow 'till the frost stops it in the end of autumn. This last shoot is sometimes of great length; and if the tree is very vigorous, it is so soft and tender as infallibly to be wholly killed by the frost; and as a number of shoots set out next

year at the end of the first shoot of the foregoing summer, it in a short time becomes a thick, bushy, stunted-like shrub, which, by continuing long within reach of cattle, is often browsed upon by them, in which case it never rises to any thing else than a shrub. Now if, with a view to give it a stem, we attempt to prune off some of the branches, as above recommended, we give it an additional degree of vigour, make it continue to grow later in winter, and of consequence cause it be infallibly killed down almost entirely each season; whereas, when it grows in the forest, although it is in the same manner killed down a little at first, yet as all the branches that are produced are left upon it, these, by being so numerous, come at length to lose that hurtful vigorousness, and thus get time to acquire a proper degree of firmness, so as to be able to resist the frost in winter, after which

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none of them are ever killed down: and as some strong shoot gradually takes the lead of the rest, especially if tolerably thick planted, that becomes a stem, and in that situation it advances ever afterwards without interruption. This is the natural progress of the oak; and thus treated, we have few soils on which it will not thrive.

I doubt much if it be possible to rear the oak to perfection in single rows, or detached trees in an exposed situation; and if ever the pruning-knife can at all be applied to a young oak with propriety, it must be by doing it in the month of *August* or *September*; for, at that time of the year, lopping off any of the branches checks the growth of the tree for that season, and gives the tender shoots that are left, time to harden before the frosts come on, in which case they are not killed down. This I have tried, for the sake of experiment, several times, and never found it fail. Many  
other

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other trees, that are apt to lose their tops in winter, may be preserved by the same means, or by stripping off their leaves at that season, as I have likewise experienced. Even the ash-leaved American maple, which, without this care, never fails to be killed down a great way, even in our mildest winters, I have preserved in the severest winters we have, without losing an inch, by this means alone.

AGRICOLA.

THE END.



